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[The following are translations of selected articles in the Russian-language monthly journal AVIATSIYA I KOSMONAVTIKA published in Moscow. Refer to the table of contents for a listing of any articles not translated.]

AVIATION AND COSMONAUTICS

No 5, May 1990

Needs of Staff Officer Training Discussed

90R90004A Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 5, May 90 (signed to press 4 Apr 90) pp 13-14

[Article, published under the heading "Combat Training: Viewpoints, Suggestions," by Cols A. Solodukhin and V. Saperov, candidates of military sciences: "How Should Staff Officers Be Trained?"]

[Text] Our country's adoption of a new defense doctrine grounded on the principle of reasonable sufficiency demanded a change to qualitative parameters of military organizational development. It also calls for a change in approach to the training of cadres in general and staff cadres in particular. Demands on the latter form the basis of a model of activity of a given category of personnel and define curriculum at the Air Force Academy imeni Yu. A. Gagarin. However, the existing academy procedure of organization of the training and indoctrination process, training schedules and curricula fail to ensure full accomplishment of assigned tasks, engendering a number of conflicts and problems. Resolving these problems boils down to seeking answers to the following questions: who should be taught what, how, and by whom?

The end results of training of staff officers, as of other specialist personnel, are determined in large part by the qualitative makeup of the students. And not everything is determined solely by a high degree of demandingness on the part of instructors at entrance examinations, for there exists an allocation, which must be met regardless of the level of knowledge on the part of enrolling personnel. The prescribed 50-percent reserved allocation for secondary-school graduates fails to solve the problem, nor does preliminary screening and selection. And this latter is presently conducted taking certain requirements into account. These include five years service in a commissioned officer's billet, the specified category of this position (a rank of major, as a rule), and preliminary verification of knowledge by military district commissions. But nevertheless significant success has not yet been achieved in this matter.

Records indicate that more than 85 percent of secondary-school graduates receive marks of 3 and 4 at service school, and 50 percent of these are straight C students [absolyutnyye troyechniki]. Therefore we feel that it would make sense to establish a certain qualification standard for applicants' knowledge in order to be accepted to the academy. For example, a grade point average of not less than 4.0 upon graduating from service school. And the entire screening and selection process should begin with analysis of one's record of academic progress. An effective obstacle must be put up against mediocrity, which is of no benefit to the military, for practical experience indicates that half of students who were C students in the past continue to be C students. In addition, it is essential to devise a special method and to test secondary-school graduates on an indicator which is of considerable importance for a leader: organizing ability. With the present state of affairs, when everything is decided at the local level, commander conclusions are not always objective.

A heterogeneous makeup of a given group of students is an important feature. Officers representing from 10 to 12 military occupational specialties and with a varying level of knowledge of theory and level of skills enroll in a staff-officer curriculum, and yet the same curriculum is prescribed for everybody. But resolving this problem is beyond the jurisdiction of the academy command element. And yet measures must be taken, and without delay, in order to improve things. What approaches are possible here? In our opinion it is essential rigorously to prescribe the categories of candidates for enrollment. We feel that they should be operations section officers, regimental chiefs of staff and their deputies.

Qualifications models of graduates provide an answer to the question "what should be taught?". Such models have been prepared at all educational institutions, including the academy, and constitute a standard of measurement—a "government procurement order" for specialist personnel. But curricula as well as training curriculum plans and schedules, structural-logical schemes and instructional methods should answer the question "how should one be taught?". Traditionally students take a large number of subjects, which are poorly coordinated with one another and do not always produce an end result: preparedness to perform practical work in specific job assignments. Graduates require an extended period of time (up to one year) in the line units in order to become fully broken-in and familiarized with their assigned position, which frequently is not an entirely painless process.

For this reason changeover to a so-called "block" system of instruction could constitute a significant step forward. All departments should teach their subjects not in a separate manner but in a close interlinkage with one another, by stages and areas of practical activities, providing their students with knowledge, skills and abilities in conformity with the prescribed model of the school's graduate. And this should be accomplished by performing integrated tactical, operational, and practical tasks, within the framework of which all types of instructional activities should be utilized: lectures, seminars, group training drills, game-type exercises, command post exercises, and special tactical exercises.

Full-scale transition to such a system of instruction will require organizational changes which presuppose enhancement of the role of the curriculum department as a generating and coordinating agency in determining change in the structure and functions of instruction. At the same time the departments should be removed from the command and navigation faculties and be placed under the academy's deputy commanding officer for

instruction and scientific research, giving them greater autonomy. Resident students should be consolidated into a single faculty. The experience of the correspondence faculty, special faculty, faculty of advanced training, and the general academic departments confirm the advisability of such a step.

Practical experience also suggests the need to put an end to guidelines handed down from the "higher echelon" on the study of various subjects or parts of subjects, since this inhibits to a considerable degree the initiative and autonomy of the academy and the departments. As an alternative one could devise uniform integral officer cadre training programs, beginning with service schools and ending with discharge from the Armed Forces. These integral programs should clearly specify the scope of knowledge, skills and abilities in the principal military occupational specialty areas at various stages of career growth. The configurations of such curricula follow the sequence: DOSAAF - service school - line unit - course of study at specialized training center - line unit - service academy - line unit - service academy advanced training faculty - line unit - ....

Nor can the problem of improving the quality of leader cadre training and preparation be considered apart from creation of conditions for maximum realization of the potential creative abilities of each student. We feel that the main answer here lies in individualization of instruction, which will also constitute a powerful factor for intensifying the training and indoctrination process. At the present time, however, the latter is of a clearly-marked collective character, especially in the course of study during the final year preceding graduation. The principal types of instructional activities (group training drills, command post exercises, game-type exercises, etc) are not designed for an individual approach.

Therefore, in addition to writing mandatory term papers and senior theses (problems), it is essential extensively to involve students in activities within the military scientific society group functioning within the department, in the conduct of research according to scientific research plan and schedule, and in practical teaching activities. For those who have shown a proclivity for scientific research and teaching activities, it is desirable to conduct specific instructional activities pertaining to specific courses or portions of courses, using time allocated for independent study.

Close interaction between a commanding officer and his chief of staff or executive officer in the daily military routine makes it necessary that they train jointly in the same departments. In this instance staff officers can improve themselves in their area of specialization on an elective basis during assigned instructional time each semester, during line-unit tour of duty, at command post exercises, and when preparing term paper and senior thesis. At the present time, however, training of these categories of students differs substantially in many important subject areas (air component tactics, combat and mobilization readiness, etc).

Practical realities also urgently demand qualitative changes in management of the training and indoctrination process. It is high time to move from command and pressure methods to methods of incentive, which will help create an unpressured, productive atmosphere within training groups of students and at the same time will focus them toward effective work performance with full return on expended effort. First of all we must totally reject the traditional schoolmaster's approach to grading every response in class. We have had positive results and experience in this area. Secondly, one should not count on rigid regimentation of independent study. One can intensify student independent work effort by maximally intensifying class sessions and making quizzes and exams tough. Third, we must overcome timidity and wash a student out for academic failure from any year of study. Up to the present, however, instructors frequently do students a disservice and do harm to the common cause by being too easy on the students. Fourth, possibilities of selecting one's duty assignment upon graduation from the academy by all students, depending on academic performance, should be implemented on a democratic basis (taking into consideration the opinions of one's classmates).

And, finally, an answer to the question "who should be teaching?" is of considerable importance. Everybody is well aware of the fact that you cannot do a good job of teaching to another person that which you yourself are unable to do or have not done. Hence the conclusion that future executive officers and chiefs of staff should be taught only by those who possess practical work experience precisely in such a staff billet, who have enriched their practical experience with knowledge of theory, and who have the ability to teach.

Life moves on, however, and everything acquired in the past is forgotten and becomes obsolete. We therefore need a well-devised system of teacher advanced training. It should provide both advanced training in theory as well as practical tour of duty in line units. While the situation is fairly adequate as regards tour of duty in line units, advanced training in theory has been ignored. Over a period of 10 to 15 years teaching faculty virtually never take any courses, which naturally has an effect on their overall level of scientific knowledgeability. Nor is the holding of interdepartmental and interschool seminars on current issues and exchange of know-how being widely used at present. Thus we have many problems, but time is not standing still. We absolutely must apply common efforts to resolve these problems.

Air Crashes During Armenia Earthquake Relief Analyzed

90R90004B Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 5, May 90 (signed to press 4 Apr 90) pp 15-17

[Article by Col A. Yudenko: "Aircrews Rushed to Their Aid...."]

[Text] The skies over the Transcaucasus swarmed with aircraft during those tragic days in December 1988. Aircraft converged from every part of the world, carrying supplies and experts in earthquake recovery efforts to the disaster area. Mighty Ruslans [Antonov An-124 Condor], Boeings, Antaeus [Antonov An-22 Cock] and Ilyushins, representing various airlines and government organizations, from the very first days following the earthquake were delivering large quantities of construction cranes, excavators, bulldozers, food and medical supplies. The peoples of the entire world extended a helping hand to Armenia, the site of the earthquake. Serving from the very beginning as a member of the operations team tasked with setting up a massive airlift to Armenia, I saw with my own eyes how hard the civil aviation and Air Force Military Transport Aviation flight crews were working.

Mission briefing, preflight preparations, flight to the cargo-loading point, refueling, loading cargo, flight to the disaster area, where as a rule there might not be an available slot in the approach and landing sequence for Yerevan (Zvartnots) or Leninakan airports, landing at an alternate, refueling, waiting for departure clearance, resumption of flight to the destination, landing, unloading cargo, and then again takeoff.... Some crews made repeated departures but, due to crowded airspace or lack of ramp space at the destination airports, would return to their alternates to refuel and wait for departure clearance. Another factor was the limited capability to use navaids and communications in the conditions of mountainous terrain. And there was constant pressure: faster, faster, the victims are waiting for help! All this naturally placed considerable physical and psychological-emotional stresses on the flight crews.

Air traffic control (ATC) personnel working Yerevan and Leninakan airports, who lacked experience in handling such heavy air traffic, were subjected to no less severe psychological and emotional stresses. It is no routine operation when several dozen aircraft are in Yerevan terminal airspace simultaneously! Priority would be given to foreign transport aircraft, which also presented additional difficulties in organizing air traffic control.

In spite of this, however, the flow of airlifted supplies continued uninterrupted. The massive airlift was working.

And then... the government reported fatal air crashes. The first crash, on 11 December, involved an Il-76 military transport aircraft on a landing approach to the Leninakan airport, while the second crash, on 12 December, involved a Yugoslavian Air Force An-12 which was on a landing approach to Yerevan airport. Fatalities included not only the flight crews, but in addition 69 military personnel of a local civil defense unit who were on board the Il-76.

Although the circumstances of these two fatal crashes were generally similar (a landing approach at night above mountainous terrain, operations in response to an emergency situation, high psychophysiological stresses), there were also considerable differences in the specific circumstances and causes of each of these accidents. This also applied to the respective measures and recommendations for preventing similar accidents in the future which proceeded from these specific incidents. Official boards of inquiry made a thorough investigation of the facts and circumstances of these air tragedies.

Just what happened on those tragic nights in December 1988?

The crew of the Il-76 military transport aircraft (aircraft commander Capt N. Brylev) had been assigned the job of flying supplies and 69 military personnel of a local civil defense unit to the municipal airport at Leninakan. Weather conditions that night were favorable, and the flight physicals conducted by military doctors indicated no health problems in the members of the flight crew.

As they were approaching the destination, the crew made a stepped descent to the prescribed altitudes, commencing descent at the prescribed points and with ATC permission. During the final phase of the flight, after passing through the transition altitude, the tower controller cleared the pilot for a straight-in approach and gave him the numbers (runway threshold barometer reading 634 mm Hg, and 1,100 meters, pressure altitude to which the crew was cleared to descend for the final approach phase).

The copilot, receiving from the tower controller the terminal barometer setting and confirming receipt of this information, failed to repeat the barometric pressure reading to the other flight-deck crewmembers. The aircraft commander, who had not correctly heard the exchange with the tower, erroneously ordered the altimeters to be set to 734 mm Hg (instead of 634), resulting in an altimeter reading of 2,700 meters (actual altitude was 1,600 meters). The navigator and co-pilot confirmed the altimeter reading. Nor could it have been otherwise, since the incorrect altitude reading, caused by incorrect altimeter setting, was repeated on all altimeters. Nobody corrected the pilot's mistake, and the aircraft proceeded to descend, with its altimeters reading 1,100 meters high. The aircraft flew into a mountain as it was descending, with the altimeters reading 1,425 meters.

None of the crew suspected anything right up to the moment of impact. Flight-deck conversation recorded by the cockpit voice recorder, which was recovered intact from the crash site, confirmed that the approach descent was proceeding normally. The only slight cause for concern was the unusual position of the aircraft ahead of them on the approach. The pilot commented: "Hey, navigator, could he be climbing? No, he is landing...."

In fact, the aircraft out ahead, which had departed from the same airfield 10 minutes before their departure and which had been a matter of constant concern to the crew in connection with the possibility that the time separation between aircraft was decreasing, was flying a landing approach to Leninakan airport and of course constituted an additional factor distracting the crew's attention.

A review of the flight-deck interphone communications by the crew of the aircraft landing ahead of them in the sequence revealed a similar altimeter-setting error. But it was noticed in time by senior flight technician Captain Semenov, which indicates a heads-up flight crew.

Thus it was the error made by Capt N. Brylev's crew in setting the altimeters to the destination field, as a consequence of which the altimeters read 1,100 meters high, which resulted in the fatal crash.

Contributing factors to the tragic outcome of this flight were the complex air traffic and navigation situation en route and in the destination area, diminished effort to backstop one another on the part of the crew members during the landing approach phase, and inadequate verification of adherence to flight work-load and rest standards on the part of the aircrew's superiors. This is confirmed by the fact that crewmembers had worked 36 hours up to the eve of the flight. Their allocated sleeping time, from 2000 to 0350 hours, had been interrupted at 2300 hours by the flight call. At 2400 hours the crew was finally sent back to resume their rest. And conditions for crew rest were far from optimal.

At this point I would like to emphasize the following. The USSR Armed Forces Manual of Flight Operations (NPP-88) states that during training exercises and when performing special assignments the number of flights, total flight time logged, and crew departure time shall be determined by the commanding officer. But in this case he himself was in the same situation and was unable to keep a check on the crew. This function should have been performed by the appropriate command and control facilities. Unfortunately, however....

In this emergency situation all crews worked selflessly, with total exertion of emotional and physical energy. The main thing was to get help to the victims as quickly as possible. And it is possible that the flight regulation which specifies the limit of human psychological and physical capability was ignored in order to achieve this goal. How frequently in recent years we have viewed man as a mere appendage to a machine!

As for interaction and coordination among crew members, we should emphasize the following detail. The navigator (as the one who most frequently, by virtue of his job, encounters problems of flying above mountain terrain and who possesses a great deal of practical experience of flying in these conditions) should have noted that, with the airfield at an elevation of 1,506 meters above sea level, barometric pressure at the runway threshold should not have been greater than 700 mm Hg, even with the most unfavorable barometric pressure trend. And yet he tacitly accepted the figure stated by the aircraft commander....

The fatal crash of the Il-76 was followed by another crash.

A crew under the command of Lt Col P. Marinkovich, following intensive, protracted flight preparation, having successfully crossed through Bulgarian and Turkish airspace, was guided to the Yerevan terminal area to initiate a landing approach. After the aircraft was locked onto automatic tracking from the ATC automatic control position, a component of the Start automated air traffic control system (AS UVD), and following positive identification on the radar, the ATC controller, having determined that he was not receiving from the aircraft continuous information on the aircraft's current altitude, decided to handle the flight on the basis of position coordinate information and radioed reports from the crew, in connection with which he was unable to monitor the aircraft's altitude on his display.

On handoff to approach control, the crew reported level at the assigned altitude to approach controller G. Yegizaryan. In establishing radio contact with the aircraft, however, the approach controller failed to follow international flight operations recommendations on verifying that the aircrew was briefed on the approach currently being used and had received the current ATIS terminal information message on active runway, winds, altimeter setting and runway conditions (the aircraft was abeam of the outer marker at this time).

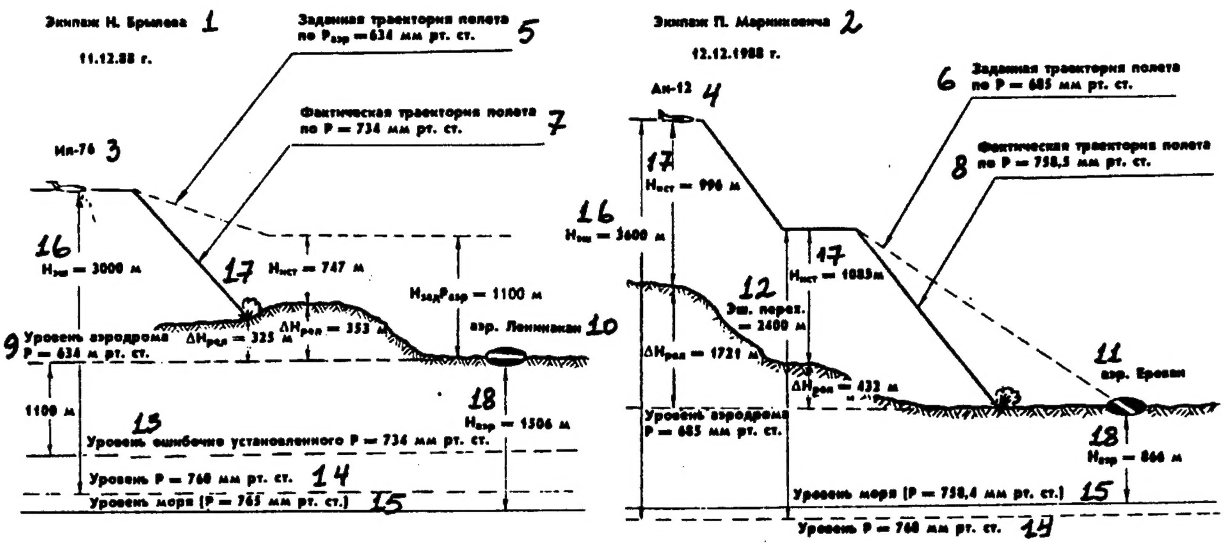
The tower controller, just as the approach controller, in violation of the requirements of Civil Aviation Air Traffic Procedures, failed to require that the crew confirm that it had received the ATIS information (this requirement has not been incorporated into Yerevan airport's Start Automated Air Traffic Control system ATC procedures). The accident investigation board established, however, that the crew had received the ATIS information, indicated by the fact that one of the aircraft's radios was tuned to the ATIS frequency and the fact that the crew had not inquired about terminal weather and landing conditions at any time during the approach.

Air traffic control, which was actively guiding the approach, by giving instructions to change heading and modify the approach configuration, was in part altering the landing approach procedure as indicated on the Jeppesen approach plate, while failing to inform the flight crew of this fact. This made it difficult to determine the aircraft's precise position on the approach, since the airborne equipment did not enable the pilot to fly the approach with a high degree of precision (Yerevan airport's terminal navigation system is not compatible with the VOR-DME [Visual Omni Range - Distance Measuring Equipment] system equipment carried by the aircraft).

All indications are that the crew was assuming that the controller-guided approach followed the Jeppesen approach plate procedure and, descending at a rapid rate, was taking vigorous measures to establish altitudes

Atmospheric Pressure and Altimeter Readings on Landing Approach

**Распределение атмосферного давления
и уровней отсчета высоты при заходе на посадку**



Key:
1. N. Brylev's crew
2. P. Marinkovich's crew
3. Il-76
4. An-12
5. Prescribed flight path at destination field altimeter setting P_{aep}=634 mm Hg
6. Prescribed flight path at destination field altimeter setting P=685 mm Hg
7. Actual flight path with altimeter setting P=734 mm Hg
8. Actual flight path with altimeter setting P=758.5 mm Hg
9. Destination field barometric pressure
10. Leninakan airport
11. Yerevan airport
12. Transition altitude
13. Airfield elevation according to incorrect altimeter setting
14. Barometric pressure setting
15. Sea level
16. Altitude
17. Height above terrain
18. Field elevation

which (in the crew's opinion) were considerably higher than the prescribed altitudes and were wrong for a straight-in approach.

Conduct of intensive radio communications (intensity of radio communications was running almost one word per second during the last three minutes, right up to impact), and communications being conducted in a foreign language, virtually prevented the copilot from monitoring the aircraft's progress. In addition, the fact that cockpit conversation connected with preparing for the landing, particularly intensive after the controller instructed the pilot to continue his approach descent, superimposed on the air-to-ground communications, also diverted the other crewmembers to a considerable degree from monitoring altitude.

The controller, continuing to give heading change instructions, cleared the aircraft to descend to traffic-pattern altitude, immediately thereafter (10 seconds later) informed the crew of transition altitude and, without a request from the crew, gave the field altimeter setting adjusted to sea level (Standard Atmosphere), 1,011 millibars (758.4 mm Hg), which apparently caused the crew to maintain altitude at this altimeter setting, and subsequently led to the crash.

The pilot was reading altitude with his altimeter set to Standard Atmosphere (airfield barometric pressure adjusted to sea level was set on the pilot's and copilot's altimeters, which were found at the crash site), while establishing altitudes instructed by the tower controller, who assumed that the aircraft's altimeters were set to the runway threshold barometric pressure. The copilot, not

monitoring and not reporting reaching the prescribed altitudes, was confirming receipt of altitude change instructions.

A sharp increase in volume of prelanding procedures connected with maneuvering to final approach heading, slowing the aircraft to gear-extension and flap-extension speed, and the fact that there was little time to perform all procedures, led to failure to monitor altitude.

Particular difficulty was caused by the maneuver onto final approach, since in the process of the turn onto final the controller, realizing that the turn had started late and that the aircraft was getting too far from the final approach course centerline, kept giving heading change instructions without monitoring altitude. In the process of turning onto final, the aircraft crew, receiving frequent heading change instructions from the controller, heading which differed considerably from the final approach course (a discrepancy of 85°, expressed doubt as to the correctness and urgency of the heading change instructions, as a result of which the pilot was delayed in making the heading changes. Figuring on a straight-in approach, the pilot continued the excessively-rapid descent, failing to monitor the radar altimeter to determine his actual height above ground level, which brought the aircraft below minimum safe altitude and, with the approach being flown on a dark night, resulted in the aircraft hitting a highway overpass.

We should note that the airfield elevation and traffic pattern altitude respectively were set high on the pilot's and copilot's altimeters. But nobody was monitoring these altimeter readings during the critical final approach phase.

An analysis of the altitude readings of both aircraft which crashed (see diagrams) shows how similar they are, which confirms the cause-and-effect relationship between these accidents and aircrew errors in using altimeters in conditions of mountainous terrain. In the first instance it was due to an error in setting the altimeters to runway threshold barometric pressure. In the second instance it was due to the crew's failure to observe the specific requirements of national regulations during flight in Soviet airspace, which require that an aircraft hold altitude after passing the transition altitude based on runway threshold barometric pressure, while according to ICAO (International Civil Aviation Organization) regulations this altitude is maintained at destination field barometric pressure adjusted to sea level.

The board which investigated the second accident recommended that authorities consider the possibility of conducting flight operations in a terminal area following ICAO regulations, that is, maintaining altitude after passing the transition altitude according to destination field barometric pressure adjusted to sea level. It was also recommended that work be done toward further standardization of flight procedures and air traffic control procedures adopted in the USSR in conformity with ICAO standards and recommendations. This applies primarily to air traffic control procedures, where it is necessary to reflect the specific features of handling aircraft of foreign airlines taking into account ICAO requirements and recommendations, which prescribe that flight crews shall be informed upon reaching flight altitude after passing transition altitude based on runway threshold barometric pressure (in conformity with national requirements of flight operations in Soviet airspace).

In addition one must consider the psychophysiological peculiarities of flight crew members. Flying at night to an unfamiliar high-elevation airfield following long and tiring preparations (on the eve of departure Lt Col P. Marinkovich's crew had also worked more than 15 hours continuous), the increased neuroemotional effect of flight conditions in the area of a natural disaster could not help but negatively affect flight personnel work efficiency. Sad experience teaches us that even in emergency conditions one should not overrate man's psychological and physical abilities, and particularly in the case of aviators. Under no circumstances should there be a departure from flight safety procedures. Otherwise misfortune is unavoidable.

Unfortunately such a tragedy was not long in coming. On 20 October 1989 a Ministry of Civil Aviation Il-76, which was bringing specialist personnel and supplies to the Armenian people, the victims of the 1988 earthquake, crashed on approach to Leninakan airport. Once again the fatal accident resulted from flight crew error in setting the altimeter.

After passing the transition altitude, aircraft commander Motkin mistakenly set his altimeter to 734 mm Hg instead of the 634 mm Hg runway threshold barometric pressure specified by ATC. This resulted in the altimeter reading 1,100 meters high. That is, this was virtually a repeat of the mistake made by Capt N. Brylev's crew. As before, none of the crew prevented the pilot's gross error, which led to a tragic accident.

What is the solution? Why is it that recently flights in mountainous areas have been ending so tragically? What fundamental steps must be taken to prevent such tragic accidents from happening again?

In addition to refining and detailing the job duties of crewmembers during each phase of a flight, it makes sense to turn once again to the recommendations of the boards which investigated the above-described air accidents and remind personnel to follow ICAO procedures in terminal areas. In this instance we are talking about maintaining altitude, after passing transition altitude, according to airfield barometric pressure adjusted to sea level.

A question naturally arises: will these procedures in fact make the landing approach safer? After all, it will require considerable work to retrain ATC personnel and aircrews, as well as the revision of air navigation information documents and various manuals. In addition, there arises the problem of using this procedure when landing

at airfields under ministry jurisdiction. And what about flight operations in terminal airspace? If an aircraft is flying in from elsewhere, the approach is flown applying ICAO procedures, but are other procedures followed by local traffic? We can arrive at answers to these questions.

Many years of mishap-free flying by many USSR Armed Forces and Ministry of Civil Aviation flight crews as well as flight crews of other ministerial jurisdiction attest to the fact that when crews are appropriately trained and prepared, when aircraft are properly prepared and maintained, and with observance of the requirements of documents regulating flight operations, it is possible to achieve mishap-free flight operations in all conditions, even such extreme conditions as was the case in Afghanistan, for example, and during earthquake recovery efforts in Armenia. This experience must be studied, synthesized, and disseminated among aviation personnel. In addition, we cannot keep on forever ignoring the recommendations of ICAO, which in formulating flight rules and regulations takes into consideration many years of practical flying experience by the flight crews of all this organization's member countries. Otherwise one might say that we are like that soldier who is convinced that he alone is marching in step. while the rest of the company is out of step.

The Ground Forward Air Controller in Afghanistan

90R90004C Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 5, May 90 (signed to press 4 Apr 90) pp 18-19

[Article, published under the heading "Combat Readiness and Flight Safety: Viewpoints, Opinions," by Col I. Alpatov: "Forward Air Controller (Experience of Combat Operations in Afghanistan)"]

[Text] The important and sometimes determining role of the avianavodchik [ground forward air controller (FAC) or air liaison officer (ALO)] constituted one of the most important features of combat operations by air assets in Afghanistan. It is quite understandable that the military occupational specialty of avianavodchik, as an air representative who is assigned to ground units and who performs missions assisting in achieving operation objectives, missions which are of vital importance to the ground unit, by guiding incoming CAS pilots over the battlefield, became rather well defined precisely during this period. It is precisely for this reason that it is entirely logical that the job done by the ground FAC in Afghanistan immediately drew the attention of military specialists, by virtue of the significance, complexity, and specific features of his job, including the existence of a certain dramatic component.

I believe that the experience amassed to date enables us to approach the matter of resolving the entire aggregate of questions connected with the functions of ground forward air controller. It is important to determine the ways to increase the effectiveness of his job, to examine the difficulties which ground FACs encounter in their work, and to validate measures aimed at eliminating these difficulties. Before attempting to do this, I shall give the floor to former ground forward air controller Lt Col V. Burkov, who took active part in combat operations in Afghanistan, and who today serves as a field command and control inspector. During our interview I asked him to cite an example which would fully reflect the substance and significance of the job of ground FAC/ALO, both for the benefit of ground troops and for effective air-to-ground operations.

"Essentially in any combat assignment, whether it involves escorting a truck convoy or freeing a vast expanse of ground, the ground forward air controller or air liaison officer performs the most urgent tasks, which in large measure determine the outcome of battle. For example, a Soviet assault force, two battalions in strength, was mounting an operation to clear enemy troops from a certain area. In the course of the march, due to a gradual worsening of the situation, caused by a buildup of enemy forces, the assault force found itself entirely surrounded and began to receive intensive fire along practically the entire defensive perimeter. As a result we were forced to seek shelter in a dry irrigation ditch, the far end of which abutted a small stream which meandered along the valley.

"Our withdrawal was, quite frankly, not following academy canons, but was moving at a good pace. By some miracle we succeeded in intercepting an enemy element which was attempting to cut off our routes of withdrawal from another, perpendicular irrigation ditch. This did not end our misadventures, however. The enemy diverted water into our ditch from the stream to which the ditch connected. The water was coming up to our necks, and streams of machinegun tracer were running thick overhead. Death seemed unavoidable, but.... We were saved by the fact that, while on the run, I succeeded in making contact with a helicopter element on alert. In addition, I had succeeded in replenishing my supply of smoke candles with some I obtained from Afghan soldiers.

"The situation remained critical: water below us, lead above us, but the Mi-24s were already proceeding to orbit overhead. The rest was a matter of procedure or, more precisely, method. I sequentially guided them onto the enemy positions from which we were receiving the heaviest fire. I had a clear view of the enemy positions, since I was closer to them than the rest of our force (as should be the case with a ground FAC). The intensity of fire on us diminished with each helicopter attack run; the bandit force was losing fighting capability before our very eyes, and as a result of the airstrikes was broken up entirely. Our ground force was not only saved from sure annihilation but had also fully preserved its capability to fight. This example confirms the conclusion that in order for an air liaison officer to be able to do such a job, which on the surface seems to be a very clear and simple task,

his training and preparation must be fully in keeping with the demands imposed on today's military specialist personnel."

In order to perform his job, the ground FAC must possess thorough training covering a broad range of combined-arms and aviation military occupational specialties, must possess the requisite individual-psychological qualities, and must possess a high degree of physical fitness.

What is required to perform his job? Of primary importance for a ground forward air controller is a high degree of proficiency as a combat air controller. In addition, he must be familiar with the tactics of conduct of combined-arms combat and the tactics of employment of air assets, and he must know how to direct mutual fire coordination between ground troops and air, and he must be able to control rotary-wing and fixed-wing aircraft over the battlefield, while as a rule himself being under hostile fire.

Proceeding from the ground troops' needs, he frequently must formulate the mission, on the basis of his knowledge of the performance capabilities of the specific types of aircraft with which he is working, in such a manner as to ensure effective accomplishment of the mission, while at the same time preventing the helicopters and fixed-wing aircraft under his guidance from getting into dangerous situations, both caused by hostile air defense action and by the local terrain.

Experience indicates that it is highly advisable that the air liaison officer be thoroughly familiar with those ergonomic features of a given aircraft which determine the conditions of target detection and attack. In particular, these include capability to see terrain features or other reference points, targeting and aiming procedure, the finer points of flying the target pass, and other conditions which determine the effectiveness of weapons delivery and flight safety. An important role in successful air control is played by knowledge of the requirements of guideline documents on the basis of which aircrew activities are organized.

In order to do his job successfully, he must have the ability to direct several aircraft simultaneously (taking into consideration the possibility of sudden situation change and the peculiarities of the local terrain), making an effort totally to eliminate the possibility of accidentally placing fire on friendly troops. Comprehensive assessment of the air and ground situation includes selecting a helicopter landing site and organization of helicopter off-loading and loading. In his capacity as a combined-arms officer, he must maintain communications not only with the CAS pilots but also with special-forces ground units, for many operations, such as an operation with the objective of breaking out a pinned-down assault force, are carried out not only with air-strikes but also by breakthrough accomplished by ground subunits.

As an air-assault trooper moving with an assault element, he must possess the required physical conditioning, a mastery of all types of weapons and pyrotechnics, and be able to operate night or day. One of the most important factors which determine the nature of the ground forward air controller's job, the significance of his contribution toward attaining the combat objective and his social and legal position within the military structure is the extreme nature of the conditions in which he functions. The very process of guiding aircraft to the target, which prescribes that the ground FAC mark his own position (for example, with orange smoke, which as a rule is also spotted by the enemy), even in the normal configuration results in the creation of conditions in which it becomes a primary mission. That is, the ground FAC's mission involves knowingly creating a highly-dramatic situation which is dangerous for him. Such a thesis would seem to be fundamentally unacceptable in view of the high level of development of military hardware, electronic gear and organization for combat. I therefore feel that the search for ways to improve the ground forward air control guidance system must be continued precisely in this direction.

One should bear in mind that the air liaison officer is exposed to greater danger not only in the active phase of battle but also during such time as he is located (displacing) in a tactical area of operations, by virtue of the fact that the tools of his trade tend to reveal his location. At the same time the lives of the entire combat force frequently depend on how precisely he does his job and on his skill in conditions of highly-fluid maneuver combat conducted in mountain terrain by individual subunits. This naturally forms a particular attitude toward him on the part of the men of the unit to which he is assigned.

In conditions of such a combination of circumstances, demands not only on the job proficiency of the FAC/ALO but on him as an individual as well increase greatly. In spite of his youth, he must be a socially-mature individual, who knowingly risks his life in the interests of accomplishing the overall missions and who is well aware of the significance of the results of his actions. Of course he must count on a certain degree of understanding on the part of his fellow soldiers, which implies elements of social prestige.

On this basis it is possible to form a number of requirements pertaining to job (psychological) aptitude screening and selection, requirements which the ground forward air controller should meet. First and foremost in order to maintain a high degree of fitness, working efficiency and professional reliability in conditions which can be characterized as extreme, even for military specialists. He must possess a high degree of emotional stability, excellent performance qualities, and appropriate potential as regards psychological and physical response. In addition, of considerable importance are such qualities as the capability of space-and-time concept and abstract thinking, which enable him to put himself in the place of the CAS aircrew he is controlling;

nervous system pliability; alertness and the ability to respond instantly, which enable him to react flexibly to constant situation changes, to retarget pilots, and to adjust their actions; a feeling of responsibility.

As was indicated by an analysis of initial premises and practical experience, former pilots and navigators, who for various reasons are no longer flying, but who remain attached to aviation, do the best job of ground forward air controller. Tactical control officers/combat air controllers [ofitsery boyevogo upravleniya], headquarters staff operations section officers, and certain other specialist personnel as well, are entirely capable, following specific training, of successfully performing these duties. It makes sense to have forward air controllers accompany the crews of helicopters and, if possible, fixed-wing aircraft as well when they fly training sorties to the range. This enables them to obtain a clear picture of how terrain features look to an aircrew, on the basis of what signs or indications they spot and select a target, and what actions an aircrew performs in striking ground targets in an actual structural-temporal sequence. Obviously the principal role in resolving the problems encountered by ground forward air controllers in combat and mock combat conditions should be played by the specialists who develop their gear and equipment.

In conclusion we shall hear the opinion of Lt Col V. Burkov, as an officer who has amassed a great deal of experience in combat, military service, and life.

"Almost six years have passed since my direct participation in this war, which was extremely savage even by a military yardstick, came to an end (Valeriy Anatolyevich was gravely wounded, losing both legs), but the events I experienced continue to stir my consciousness and give rise to a great many new assessments, associations, and comparisons. I would like to relate a great deal, share a great many things, bring forth many items for general discussion. But I shall limit myself to two items.

"I still remember every detail of that dramatic combat engagement I was describing above. At the time our entire assault force was indeed at the brink of annihilation, and it certainly was no laughing matter. Strangely enough, however, today many events from this battle bring a smile, although not a very happy smile. I remember how, as we were withdrawing by bounds in order to take cover in the dry irrigation ditch, I was talking to the helicopters as I was running. As you can well imagine, conditions were not exactly ideal for talking over the radio. I pushed the mike right up against my mouth in order to make sure that they could hear my voice, as a result of which my transmission was too loud. The lead helicopter pilot kept calling: 'Why are you shouting?' (As you can understand, at that moment we were not exactly following standard radio communications phraseology). I would let go of the mike [DEMSh; noise-canceling dynamic microphone]; I needed my hand for other things (a ground FAC/ALO is perhaps more heavily loaded down with gear than any assault trooper). The mike would swing away from my mouth as I ran, and my voice would fade away. At this point I would hear in my headphones a concerned shout by the lead helicopter pilot: 'What's happened to you?' This happened several times, for which reason our radio contact was not too good while I was running, but fortunately in the end we got things established.

"While we were moving back by bounds, the lead helicopter pilot, who did not have a full picture of the situation developing around us, kept telling me: 'Mark your position.' I would reply: 'Then there will be nothing left of me or my smoke candle. Who will you talk to?' I also vividly recall incidents of 'expropriation' of smoke candles from the belt of Afghan assault troopers leaping across me."

Of course we cannot remain apart from the general social processes developing in relation to the Afghan war. As we know, a negative attitude toward our participation in this campaign developed among the general public. One can probably agree with that opinion in large measure. But does that mean that we cadre military specialists should not study the war experience and not draw necessary lessons from it?

Computer Simulation Reproduces Airstrike

90R90004D Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 5, May 90 (signed to press 4 Apr 90) pp 20-21

[Article, published under the heading "Tactics and Simulation," by Col V. Vdovin, docent and candidate of military sciences, and Lt Col A. Golovin: "Evaluating Quality"]

[Text] Improving tactical proficiency is one of the most important objectives of air unit and subunit training. Flight personnel hone their skills in the course of training flights, tactical and air exercises. The effectiveness of efforts addressing various elements of tactical training depends to a considerable degree on situation conditions, quality of analysis of mistakes, as well as the degree of objectivity in assessing crew performance.

Can all this be accomplished in practice? Facts indicate that the answer is no, not always. As a rule creating an environment maximally approximating actual combat involves considerable expenditure of manpower, time and resources. It is also difficult fully objectively to assess aircrew performance. How then can we solve the problem and ensure improvement in the level of technical training?

The Air Force is presently being equipped with computers of various types. They include personal computers for performing calculations, and specialized Luch-84 flight data monitoring and recording computers. The latter are widely used only for evaluating flying technique, as well as for evaluating the performance of aircraft systems and components. But other

tasks can also be performed with these computers. In particular, one can evaluate the quality of performance of tactical moves on all training sorties, perform statistical processing of obtained results for each aircrew, subunit, and unit, adjust base combat models, etc.

As a result of accomplishing the first of these tasks, it becomes possible to evaluate the quality of performance of tactical moves in penetrating air defense, seeking strike targets, attacking targets, weapons delivery, coordination, as well as other elements which determine the level of tactical proficiency. A flight data recorder based system should include base models of actions by individual aircrews, subunits, and units (strike delivery, air-to-air combat, specialized air mission, etc) as well as the following subsystems: simulation of combat environment elements; recording of aircraft coordinates and parameters describing its spatial attitude, operating modes of engines, airborne EW gear, navigation systems, and weapon systems; forming of actual formation parameters.

The process sequence is as follows: loading the base model into a Luch-84 system computer in conformity with the assigned mission; entry of situation data (coordinates and characteristics of targets, coordinates and types of air defense assets, topography, weather, etc); entry of flight parameters from airborne data-storage media; evaluation of effectiveness of actions by individual aircrew, subunit, or unit; output of mission performance results.

We shall examine the entire sequence in greater detail and apply it to a specific example (see figure), in which a flight of fighter-bombers is striking airfield air defense assets. After passing the enroute formation to strike run transition point, one two-ship element, as it executes the designated strike maneuver, allows itself to be detected and diverts the attention of the SAM crews. In the meantime the other two-ship element, exploiting the masking properties of the terrain and flying nap-of-the-earth, runs in on the target from another direction. Just prior to attack the aircraft break, climb, and hit the SAM positions in a diving attack. Only simulation of weapons delivery is possible at this phase.

After returning and landing at their home field, data is copied from the onboard flight data recorders to cassette, and this data is subsequently processed on an SM-1420 computer. A special program forms and records data arrays to disk. These data arrays, using a uniform time scale, contain the strike element's flight parameters: speed, altitude, G loads, bank and pitch angles, computed or recorded coordinates of points lying on the flight paths of the aircraft, as well as other information needed to construct a computer model of actions in the target area.

The next step is to form environment input data: topography, weather, location and composition of local air defense assets. This data, once prepared and entered into the computer, is stored and can be easily changed or corrected with special commands. Only visibility and time of day are asked immediately prior to solving the problem; this data is used in determining the position of sun or moon and light conditions.

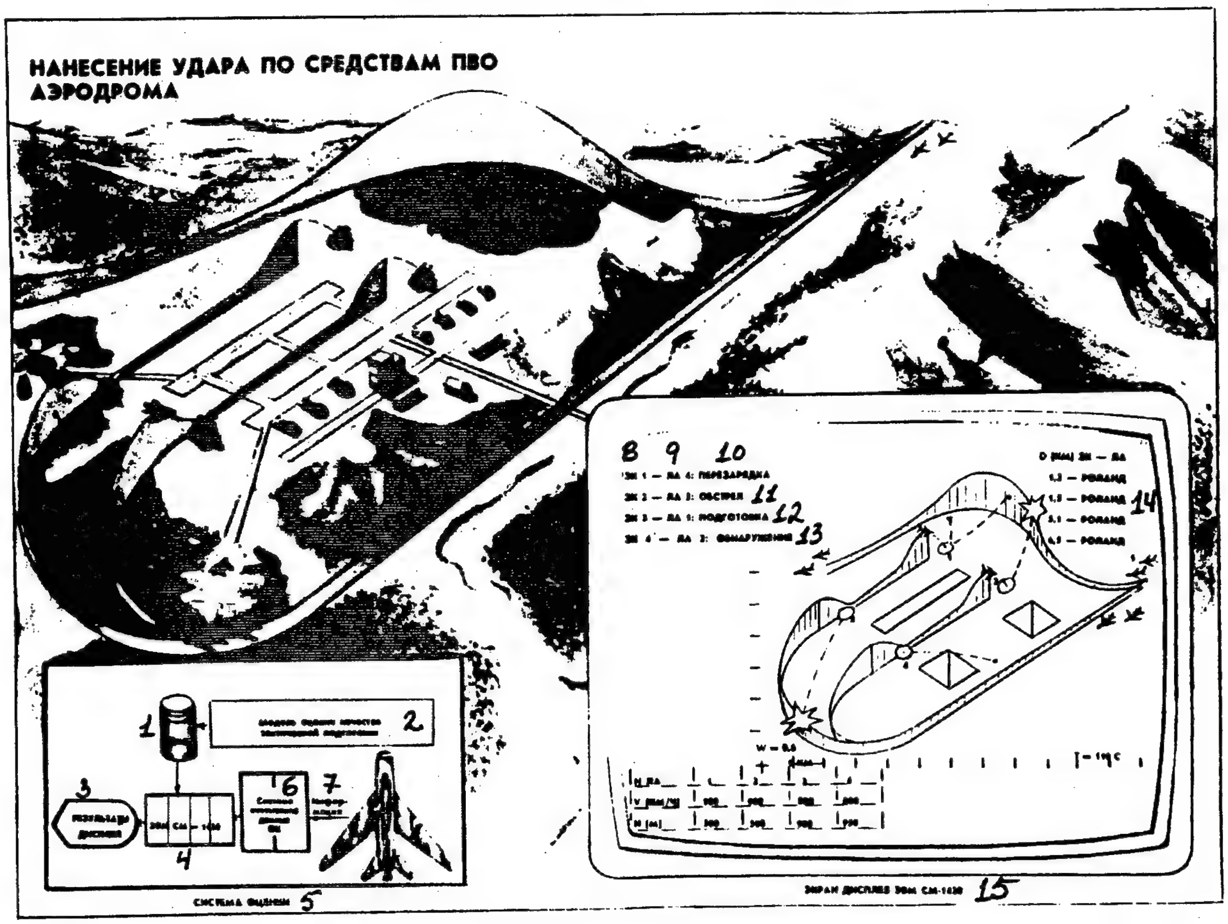
Simulation of SAM system operation commences after the strike effectiveness evaluation model is run on the computer, using the same operating system: detection and determination of moment of aircraft entry into SAM missile launch zone, missile launch and guidance, calculation of probability of missile hit, calculation of effectiveness of aircraft employment of weapons and EW assets. The entire process is simulated by means of exact reproduction of the actual flight.

The targets and environment elements, strike element flight dynamics and hostile air defense system functioning are displayed in alphanumeric and graphic form on the computer screen. Mission progress is update-displayed at specified time intervals, with display of aircraft flight paths, the parameters of aircraft movement and weapon system employment, as well as the functional status of all SAM systems, right down to the trajectory of a missile being guided to the target.

Evaluation of the effectiveness of actions by the aircraft is done based on the results of air defense penetration (number of SAM missiles launched or bursts of AAA fire, mathematical expectation of effective target hits and probability of kill for each aircraft) and aircraft weapons delivery. This data can be requested for any moment in the simulation process and in the form of a final table upon conclusion of simulation. Quality of mission performance is estimated on the basis of this information. In addition, it is very beneficial to be able repeatedly to display the dynamics of the entire strike mission. The officer conducting the after-action critique can thoroughly analyze the pilots' actions and, together with the pilots, draw up practical recommendations for correcting and preventing mistakes in the future.

The basic component of this system—a mathematical simulation model for evaluating the effectiveness of employment of tactical moves and methods of penetrating tactical air defense—has already been developed at the Air Force Academy imeni Yu. A. Gagarin and is being extensively utilized in class instruction and in the conduct of research.

Strike Delivery on Airfield Air Defenses



Key:
1. Disk.
2. Tactical training quality evaluation model.
3. Display results.
4. SM-1420 computer.
5. Evaluation system.
6. Flight data recorder data reading system.
7. Information.
8. SAM system.
9. Aircraft.
10. Reload.
11. Firing.
12. Preparation.
13. Detection.
14. Roland.
15. SM-1420 computer display

MiG-29 Fulcrum Construction, Performance Detailed

90R90004E Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 5, May 90 (signed to press 4 Apr 90) pp 22-25

[Article by Lt Col V. Dolgishev: "MiG-29: The Known and the Unknown"]

[Text] The appearance of the Soviet Air Force's MiG-29 and MiG-29 UB fighters at England's Farnborough International Air Show produced a real sensation. They possessed indisputable superiority in a number of respects over counterpart foreign-built aircraft. The fighter's excellent aerodynamic characteristics give it exceptional maneuverability and enable it to perform advanced aerobatic maneuvers elegantly and without apparent effort.

According to the general consensus, the high point of the air show was demonstration of a whip stall (climbing with airspeed dropping off practically to zero, followed by a tail slide and transition to another maneuver) by special design bureau test pilots A. Kvochur and R. Taskayev, a maneuver which previously had been done only with aerobatic lightplanes. This is not merely an "exotic" aerobatic maneuver to publicize the company's product. It could become an effective tactical move. The aircraft's unusual flight path is capable of fooling the cleverest target motion prediction algorithm in an enemy fighter's airborne computer.

The whip stall was included in the program in order to provide the greatest amount of information possible about the new aircraft. First of all, this maneuver demonstrates that the aircraft is controllable in a flight path at zero and even negative airspeeds, and that its spatial attitude does not affect stability and controllability. Secondly, one can conclude that at the low-speed (and, consequently, low dynamic pressure) end of the flight envelope, the control system is sufficiently effective and performs reliably. And finally, the whip stall maneuver graphically demonstrates the capabilities of the MiG-29's powerplant: its engines function reliably even at negative airspeeds, with the aircraft at any attitude.

The main distinctive feature of the MiG-29 is a newly-developed "integral" aerodynamic layout with improved (by approximately a factor of two!) lifting properties in comparison with previous-generation fighters. The design team at the Special Design Bureau imeni A. I. Mikoyan, under the guidance of and with the direct participation of chief designer Academician R. Belyakov, succeeded in incorporating in the design of the MiG-29 and its systems a number of unique scientific and technical innovations based on the latest research and development in the area of aircraft engineering. The main design objective was grounded in the final analysis on the following principle: while maintaining maximum simplicity of design and construction, incorporate any new innovation if it produces an appreciable qualitative improevement in the fighter's capabilities.

We shall illustrate this with an example. In contrast to the counterpart F-16 lightweight fighter, the MiG-29 is a twin-engine design, which has its advantages and drawbacks. The latter include first and foremost an increase in aircraft overall weight. A portion of the weight increase was compensated for by essentially dispensing with a fuselage. On fourth-generation fighters the fuselage as such has been eliminated and is now called "korpus" [body], which generates appreciable lift. Other possibilities were also found. Since the twin engine nacelles are wide-spaced, it was unnecessary to complicate landing-gear design in order to obtain a wider stance.

The main gear is of a simple oleo-strut construction. "Excess weight" was eliminated by employing composites where necessary. As a result the designers succeeded, by adding a second engine, not only in increasing the degree of safety from total engine failure and in improving the fighter's survivability in a combat environment, but also in obtaining a world-class powerplant with unique parameters, altitude and speed performance capabilities. A high thrust-to-weight ratio in combination with an efficient wing design and a high-performance multifunctional weapons control system enable the MiG-29 tactical air superiority fighter to perform its missions effectively by means of aggressive air-to-air combat maneuvering, close-in and medium-range all-aspect missile engagement, interception and downing of enemy strike and reconnaissance aircraft, including low-flying look-down targets.

Hero of the Soviet Union Honored Test Pilot USSR A. Fedotov made the first flight in an experimental model of the MiG-29 on 6 October 1977. This aircraft has been received with a great deal of interest in Air Force units.

"The MiG-29 is the fourth type of fighter I have qualified on," Gds Sr Lt S. Samko said about his combat aircraft. "Comparison clearly favors it: supersonic speed and outstanding maneuverability, excellent cockpit visibility and formidable armament, with capability to hit any air and ground target with assurance. No wonder it is called an air superiority fighter."

The MiG-29's principal mission is to engage enemy aircraft, to provide air cover to troops and rear services installations against air attack, and to counter hostile air reconnaissance day or night, in all weather. For this mission it has a unique weapons control system (SUV), which includes radar and electro-optical target engagement systems with onboard computers linked by data and algorithm interaction.

"Everything was done on the MiG-29 aircraft," explained M. Valdenberg, its chief designer, "to ensure that the pilot hits his target. The fire control system consists of three separate systems which support one another. The first is based on a high-performance radar, which can detect and lock a target at long range in both the forward and rear hemispheres; it can see the target regardless of whether it is against a ground background;

it is capable at the appropriate moment, when the pilot has established a favorable situation, of 'communicating' this fact to the weapons and indicating that conditions are acceptable for firing. After this all the pilot has to do is push the button. The second system is electro-optical. Its advantage is that it is passive and emits no signals; consequently the target receives no lock or tracking information. In addition, the electro-optical system provides more accurate angle tracking of the target and performs automatic lock. And, finally, the third system—also an optical system, linked to the pilot's eyes—is a so-called helmet-mounted target designation system. The pilot turns his head, following the target. This motion is perceived by the system, which turns the missile seekers toward the target. I shall cite an example. While flying above a solid undercast, you are following a target. In order not to give away your presence, you are working with the electro-optical system. You approach the target, but it plunges into the clouds. But the target does not disappear from the screen: the radar receives a signal indicating loss of optical tracking and automatically switches on: this is the support function. When the radar receives this signal, it is ready to operate and possesses information on the target's most recent position on a time line. When the target emerges from the clouds, electro-optical tracking will resume."

Principal Specifications and Performance Characteristics of Fighter Aircraft

	MiG-29	F-15C	F-16C	Mirage-2000
Length, m	17.3	19.5	15.0	14.4
Wingspan, m	11.4	13.0	9.5	9.0
Height, m	4.7	5.6	5.0	5.2
Takeoff weight, kg				
-normal	15,000	20,200	11,400	10,900
-maximum	18,000	26,500	17,000	17,000
Thrust-to-weight ratio	greater than 1.1	1.1	1.1	0.9
Maximum Mach number	greater than 2.3	to 2.5	2.0	2.2
Maximum speed, km/h	2,440	2,650	2,120	2,340
Service ceiling, m	17,000	18,300	15,200	18,000
Maximum sustained positive G force	9	9	9	9
Maximum rate of climb at sea level, m/s	330	285	260	250
Ground roll on takeoff (with afterburning), m	240	275	450	560
Ground roll on landing (with drag chute), m	600	1,070	750	-
Maximum range, km	2,100	-	-	-

In the opinion of foreign experts, the MiG-29's weapons control system has no counterpart at the present time. This system's appearance on the Soviet fighter was a total surprise to Western observers, who were convinced of their superiority in the field of electronics.

There is another, until recently highly-classified page in the biography of the MiG-29. The Soviet carrier fleet has followed its own unique path of development. Either helicopters or VTOL aircraft were landing on the decks of our cruisers ["aircraft-carrying cruisers"]. But fleet defense required the presence aboard aircraft-carrying ships of high-maneuverability, well-armed supersonic fighters with a substantial combat radius, fighters capable of launching within seconds and effectively intercepting threat aircraft at a considerable distance from the carrier. The designers and test pilots of the Special Design Bureau imeni A. I. Mikoyan worked almost a decade on perfecting, the first in this country, all elements of carrier-basing aircraft.

The modified MiG-29K features beefed-up landing gear, folding outboard wing sections, tailhook, special communications gear, and the most advanced weapons system. A ski-ramp takeoff enables it, utilizing the powerful thrust developed by its engines on afterburner, to lift off with a minimal ground roll without catapult (as is used by the Americans) devices. In November 1989 a prototype carrier-version MiG-29K supersonic fighter, flown by Hero of the Soviet Union Test Pilot 1st Class T. Aubakirov of the Special Design Bureau imeni A. I. Mikoyan, took off from the ski-ramp deck of the heavy aircraft carrier ["heavy aircraft-carrying cruiser"] "Tbilisi," a first in the history of Soviet aviation and the Soviet Navy.

In spite of the fact that the MiG-29 has been in operational service for several years, in aviation terms it is still quite young, in the process of growth and development, so to speak. Target engagement and navigation systems as well as weapons control systems, which are extending

the fighter's capabilities, are being further improved. Work is in progress to improve takeoff and landing performance, in particular by increasing flap area, as well as to extend the aircraft's range.

"Fully aware of the potential for further development inherent in this aircraft," says R. Belyakov, "specialist personnel at the Special Design Bureau imeni A. I. Mikoyan are engaged in a major, multiple-phase project to develop new versions of this fighter, which will incorporate the experience and lessons learned during the development, flight testing and operational service of the MiG-29 aircraft, as well as the latest advances in aviation science and technology."

Many aircraft builders abroad, especially long-time Mikoyan rivals in developing fighters, are currently formulating projections pertaining to the Special Design Bureau's combat aircraft of the year 2000. While giving due credit to the originality of some of the projections, senior chief designer R. Belyakov noted that subsequent versions of the extremely well-designed MiG-29 aircraft, on which versions work is currently in progress, will unquestionably still be flying at the end of this century. This fighter aircraft, which has gained wide renown thanks to this country's policy of openness and glasnost, will live a long life, in the process of which it will be improved and further developed, keeping pace with advances in aviation science and technology.

Peacetime In-Air Emergencies Described

90R90004F Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 5, May 90 (signed to press 4 Apr 90) pp 26-27

[Article, published under the heading "Successors to the Combat Veterans," by Col A. Tsepaykin: "Beyond the Point of Risk"]

[Text] **The activities and combat training of military aviators demand even in peacetime an enormous exertion of emotional and physical energy and involve constant risk. The following selection of materials, prepared by Col A. Tsepaykin, tells of the tenacity and skill of the present generation of military aviators—the sons and grandsons of combat veterans. The fighting qualities of these individuals, of varying age, life experience and military service experience, but equally dedicated to military duty, were fully manifested in emergency situations—beyond the line, so to speak, of the natural risk of the job.**

At Least There Is a Slight Chance....

On that September day political section chief Col A. Vozov was flying a training sortie in a MiG-29 fighter.

The regiment is an element of a combined unit which at that time was one of the first in the Air Force to bring the new fighter into operational service, and the political worker felt that it was his duty to study as thoroughly as possible the aircraft's "character" and capabilities, in order more fully to take these characteristics into account in planning and conducting party-political work during the period of conversion-training.

On this flight, as on previous flights, the MiG was performing flawlessly. There was no indication of problems to come. But as he was on his landing approach, the nose gear failed to extend. There was enough fuel remaining for Aleksandr Konstantinovich to employ well-known techniques of forcing the gear down.

Once around the pattern, a second time around.... Attempts at emergency gear extension were to no avail. The pilot flew violent maneuvers to generate g loads, attempting to break the nose gear free. But this too was to no effect.

Vozov declined the tower's suggestion that he eject. Nor did he consider a wheels-up landing onto an unpaved surface to be a better solution. As long as the slightest possibility remained, the pilot endeavored not only to preserve the aircraft but also to ensure that the landing would cause as little damage as possible, for otherwise it would be difficult for the maintenance people to determine the actual cause of the malfunction.

The aircraft was on final. The gray concrete runway loomed ever closer. He touched down softly and, holding the aircraft's nose off the ground, rolled down the runway.

This was the Air Force's first experience with landing a MiG-29 with unextended gear. Thanks to the pilot-political worker's courage and skill, the flight ended safely. As a result flight personnel obtained not only a course of action to take in such a situation, but also were given a graphic example of a display of excellent moral and fighting qualities by a leader-Communist.

We should note that Aleksandr Konstantinovich has encountered many problem situations in the course of his long and difficult flying career. On one occasion, back when he was a lieutenant, his canopy glass blew out at an altitude of 14,000 meters. He had an engine failure during another high-altitude flight. The pilot emerged with honor from these and other ordeals. The military labors of Col A. Vozov, his efforts in teaching and indoctrinating Air Force personnel, and his personal courage and skill, displayed in emergency situations, have been rewarded with award of the Order for Service to the Homeland and the USSR Armed Forces, 2nd Class and 3rd Class, as well as service medals.

The Courage of Captain Krivoruchko

The history of the combat operations of Soviet military aviation during the Great Patriotic War is rich in examples where pilots and aircrews managed to make it back with damaged, crippled aircraft which they were barely able to keep in the air. They came in on a wing and a prayer, as they say. There were also many such incidents in Afghanistan.

But that was war. In peacetime, however, during routine flight operations, it would seem that such a risk is not necessary. Nevertheless it is apparent that in our pilots' very blood there is the desire to fight to save their aircraft right to the last possible moment, in the most dangerous situation. Here is an example.

During an exercise a squadron of fighter-bombers was assigned the mission to support ground units in a defensive engagement. It was rainy and overcast, and for that reason the most experienced pilots were scheduled for the first sorties. They included Capt G. Krivoruchko.

...Successfully penetrating the "aggressor's" air defense, the lead pair of MiGs reached the target area. They spotted the target and commenced their attack run.

Suddenly, as they were firing their missiles, there was an explosion!

Later the experts who investigated this rarely-occurring accident established that the solid-propellant motor of one of the missiles had exploded. The explosion damaged a fuel tank, jet intake, part of the wing, and skin on the fuselage.

Krivoruchko of course was not aware of all this. But the pilot's response to the unforeseen situation was practically instantaneous. He pulled the aircraft into straight and level flight and checked to make sure that the powerplant and controls were sufficiently functional to remain airborne. Deciding to eject only as a last resort, the captain made the decision to nurse his damaged aircraft back to the field.

And he succeeded. It is true that the drag chute, as a result of damage sustained during the explosion, failed to release upon landing, and his brakes failed during rollout. But for an experienced pilot, coping with these difficulties after what had happened aloft was not really any major problem, as Krivoruchko himself put it.

Incident Over Urban Area

From the flight operations officer's log: "3 minutes and 8 seconds after liftoff, at a height of 250 meters, an An-22 aircraft, Maj A. Zaytsev, pilot in command, suddenly banked right. The aircraft proceeded to descend at a rate of 30 meters per second...."

Seconds counted. Sensing that the aircraft was not responding to the controls, Zaytsev immediately switched to the backup control system. The aircraft appeared to recover, but only for an instant.

"Skipper," the navigator called over the intercom. "We're banking right again. Rapid descent, rapid descent...."

They were only 150 meters above the ground. In addition, the heavy aircraft was turning toward an urban residential area. Within 5 or 6 seconds the situation might be hopeless. At this moment senior flight technician Captain Fomin, at Major Zaytsev's command, switched back to the primary control system. The pilot and copilot were unable to do this, since both were applying every ounce of strength to prevent a wing stall.

After switching back to the primary control system, they succeeded in bringing the aircraft back to wings level. The altimeters indicated that they were 70 meters from the ground. There was sufficient airspeed to maneuver, and the aircraft commander began a gradual climb, so that if the situation once again became critical they could get the aircraft away from town.

26 minutes after liftoff, the aircraft landed back at its field.

From the flight operations officer's log: "The actions by the aircraft commander and crew were adjudged to be correct and proper. In the difficult, swiftly moving situation caused by a malfunction in the aileron control system, the crew displayed a high degree of composure and returned safely to the departure field."

Greater Freedom of Initiative to Veteran Pilots

90R90004G Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 5, May 90 (signed to press 4 Apr 90) pp 28-30

[Article, published under the heading "Combat Training and Flight Safety: Viewpoints, Opinions," by Military Pilot 1st Class Lt Col A. Zhukov: "Halfway Measures Are Not Enough"]

[Text] **Military Pilot 1st Class A. Zhukov feels that halfway measures are not enough in the air unit combat training system, since doing things in the old way is like flailing the air.**

Absurdity Is Formally Established by Plan....

It is no secret that planning and scheduling of combat training at the regimental level is done on the basis of guideline documents prepared at the central echelon. In the process of drawing up the annual training plan and schedule, the unit's principal combat training objectives are determined, as is average flying time to be logged by aircrews, approximate number of training sorties of all types involving weapons delivery, instrument and night flying time to be logged, etc. As a result the total number of flight training planning and scheduling parameters sometimes runs as high as 60 (!) items, with as many as eight parameters pertaining to tasking designation.

In addition, the plan specifies various training activities, tests, and practice drills. There are also 30 commander-training theory subjects—approximately 500 hours—plus a separate small arms manual training plan, which requires time, not including practice drills. In addition to this there are training activities prescribed by documents received by the unit from higher-echelon headquarters. In 1988, for example, our regiment received, just in

coded form alone, 130 instructions pertaining to measures connected with organizing flight operations and preparing flight personnel and the flight operations team for running flight operations. This represents an additional 130 hours even by the most conservative figures. Not to mention documents pertaining to routine duty activities of military personnel, military discipline, and political work: there are plenty of these as well.

Let us now make an elementary time calculation, using the actual schedule for 1988. We had the following: 128 flight operations days, 24 aircraft and vehicle maintenance days, 60 preliminary preparations for flight operations days, 51 inspection and maintenance days, 24 commander training days, 24 general flight operations preparation days, and 55 days off and holidays. This totals 366 days.

A breakdown by hours looks as follows: 63 percent—commander training; 13 percent—combat training schedule activities; 7 percent—small arms training schedule activities; 17 percent—training activities required by current documents. A total of 95 working days of 8 hours each is required. But what do we have at our disposal?

Commander training hours were distributed as follows among subjects: 42 percent for Marxist-Leninist and physical training; an additional 21 percent for three primary subjects; the remaining 37 percent for... 25 subjects. On the average less than 10 hours per year for each. With this approach can one "genuinely learn military affairs"? With such a system of training is it possible productively to develop tactics in conformity with the capabilities of today's aircraft and aircraft systems? Unfortunately, no matter how you reason the matter, the absurdity contained within the plan and schedule produces a fiction at year's end.

I am by no means exaggerating. At the end-of-training-period performance evaluation ask any regimental commander if he is capable, in the span of three hours time, of completing a briefing, assessing the situation, making a decision, organizing control and coordination, etc. I guarantee that he will not at all be sure. And all this because the couple of regimental exercises and the five squadron exercises conducted during the year had been organized and prepared in advance. And there had been no real work on the elements of preparing for combat operations. The lack of instructive elements in a tactical air exercise is a direct consequence of ill-conceived planning. Breaking down combat training into air training and commander training as well as differentiation of flight training proper result in a vagueness of the end objective of training and fail to focus subunits on the ability to perform their designated missions. The same applies to commander training: a great deal is done just for the sake of going through the motions. There are many subjects, but there is no time to study them. And naturally there is no directional thrust toward an end result.

I believe that the representatives of higher headquarters are well familiar with these mutual actions by the lower and higher echelons. It is apparently for this reason that, when they visit line units, they prefer conscientiously to observe the rules of the bureaucratic game. They check not the actual but rather the "on-paper" proficiency of personnel. They inquire as to how many pilots, in what conditions and in what kind of breakdown, have been prepared for combat operations. They want to know how much flying time has been logged, how many bombing runs have been flown, how many firing sorties, etc. In short, they engage in bureaucratic bookkeeping.

"On-Paper" Combat Readiness

Today a great deal is being said to the effect that perestroyka can be successful only when people become its principal dramatis personae. Instead of a downward leveling of the individual, what is needed is the opening up of individual abilities, competition of intellects and talents; instead of phony unanimity, what is needed is a broad spectrum of opinions and views on a problem. Does the existing system of combat training (in which, incidentally, almost nothing has changed since the period of stagnation) allow a pilot's individual potential to become unchained? Let us consider the question.

A pilot comes to the line regiment from service school with certain skills and habits in preparing for flight operations and with a strong desire to become thoroughly broken-in as quickly as possible. In the present system he is under the vigilant attention of the flight commander, squadron commander, and regimental commander. All of them are to one degree or another responsible for his development. Each of these command personnel has his own personal opinion on the fastest and best way to break in a young lieutenant. Nor is this in general a bad thing. That is, unless you consider one small point. The lieutenant himself is not permitted to have an opinion regarding his own development. He has no such right, since everything has been determined by the Combat Training Program and by the decisions of methods councils and superiors. It is considered that this is, after all, for the lieutenant's own good. But is it? I shall cite my own experience.

At service school the first solo training flight in the practice area included four half rolls and four chandelles. In the line unit, flying the same type of aircraft, I flew two half rolls in two years. Or take the following. I received my first reprimand for "violation of familiarization procedures." As a result I was scheduled for a minimum of one dual flight, but the check pilot decided that this was not enough. It did not matter what arguments I brought forth: a good level of proficiency in flying in instrument weather, considerable time logged on the simulator, and a good job on the dual check ride.

Incidentally, do you think that lieutenants are the only ones subjected to harsh treatment against the pilot's professional worth? By no means. On the contrary, the more experienced you are, the more they stifle you. What

kind of system is this? If you are a pilot even with 20 years of flying and a vast amount of experience, but if, let us say, you have not been promoted to command slots, the flight commander, squadron commander, and regimental commander will still be responsible for your training. They will subjectively analyze your level of professional development, will constantly be prohibiting something, drawing up familiarization and break-in plans and schedules, etc, even if they themselves are less-proficient pilots. The pilot as a true professional, with the right to a certain amount of freedom of innovation in his daily activities, has ceased to exist. He has been replaced by a winged raw recruit, who is oppressed by restrictions and prohibitions. It is for this reason that in the regiments they do not essentially engage in genuine combat training but in endless going through the motions of reestablishing allegedly lost skills and making pilots current after not having flown for a while.

I have discussed a great deal with my colleagues the matter of who should be responsible for a pilot's training and who should determine how long he should go between flying. And each time the answer has been: an experienced pilot, who has logged a certain number of hours, is fully capable of handling this matter himself, of doing without a combat trainer or a minimum number of dual training flights, without violating the principle of progressing from the simple to the complex. The pilot should have the right to assume responsibility.

In my opinion Maj A. Korotchenko presented this issue in a very intelligent manner in an article entitled "You Have become a Pilot 1st Class. What Next?" He essentially presented a ready program of actions which I and all my fellow pilots fully support. But unfortunately the combat training people at the Air Force Main Staff did not at all respond to this most constructive and relevant article, in our opinion, to appear in this magazine last year. Nor are they planning to respond, judging by all indications. Why is this? I find it hard to understand. Perhaps they are satisfied with the present state of affairs whereby, for example, rigid regimentation of maximum time between logging flight time leads to unwarranted expenditure of fuel. But the commander is constantly faced with a problem: either the regiment's pilots will no longer be IFR current (flying at weather minimums), since there is no suitable weather available or, ignoring the weather, they will fly in VFR weather, pretending that it is IFR, and then subsequently make out the flight documents in an appropriate manner. But what is the use of such phony documents, prepared so nicely and bearing the unit's official seal?

There is another negative aspect to such an approach to training. Consider: how serious will a pilot be about preparing for a training sortie, using the flight simulator and productively practicing in the aircraft cockpit, if one can so easily become current again with a flight in the dual trainer? So what if it costs the country more this way? You can fly a dual check ride as long as you want. And if you request additional dual time, they will even praise you.

Of course some pilots need dual flying at certain times, since there is no possibility of actually reproducing the sensations of flight on "modern" cockpit simulators. In such cases, go ahead and fly dual. But why make this into a costly mandatory activity?

A pilot, just like an athlete, should always be fit. An athlete maintains his fitness through training and practice, with the objective of turning in a suitable performance in competition. It seems to me that a pilot should use the flight simulator for such fitness training, while actual flights should be for "competition," where the performance result is important. In actual fact simulators are frequently ignored, as a result of which flights to improve flying proficiency become, figuratively speaking, practices during competition. Thus we lose the end goal: what do we want—to maintain fitness or to show that level of performance which we have achieved in the course of training?

No More Flailing the Air....

The lack of harmony of arrangement and scientifically-validated definiteness in the method we employ leads to making flight personnel complacent, to loss of a sense of alertness, and to diminished concentration. I personally feel that this is the reason for what happened to Captain Malyshev. On a flight from his own field to an alternate field he forgot to lower the landing gear on final and ejected after his aircraft touched the runway. And yet Malyshev's pilot's logbook is a joy to behold. A regimental commander would envy his state of proficiency, to judge by the number and frequency of training sorties. There were no time gaps between flights logged, regardless of weather, and covering all types of combat flying and weapons delivery. In short, it was an ideal logbook. Nevertheless he had a serious, dangerous mishap. And I assure you that this is typical of the Air Force today.

There is one other matter which flight personnel are constantly raising and which is stubbornly ignored by the higher-ups. It pertains to the extent and form of preparing for flight operations. Who should determine them?

I once asked some pilots to count up how many times they had diagrammed one and the same flight assignment in their notebooks. The number ranged from 15 to 40 times. In addition, flight elements are graphically drawn up in other general-training notebooks. In the regiment we have methods diagrams of flight assignments, and the manner and sequence of their performance is contained in the combat training manual.

Ready justification is given for such duplication. At the top echelon of Air Force authority: by the desire to improve pilot preparation for flight operations. At the middle and lower echelons: by the fact that this is not necessary for any practical purpose but for the inspecting officers and for the military procuracy. Does this paper game make sense?

Here are two actual examples from combat training. During a night training sortie prescribed for the regimental tactical air exercise, Captain Chukanov failed to hit his target. It was purely by luck that nobody paid any consequences for this. That same night Captain Tarakanov got lost, and it was only thanks to precise actions taken by the higher-echelon command post that he succeeded, with a fuel-critical condition, in landing safely at an alternate field. Both are pilots 1st class. Judging from the papers, they are both highly-trained and proficient. And, an interesting coincidence, both have good drawing ability, so that their notebooks looked wonderful indeed. And you know what? These nice pictures and diagrams in fact put the inspecting officer in a difficult situation. There was nothing he could say: he had become accustomed to grading everything on the basis of documents rather than by current realities.

What is my point? It is that a 1st class rating and proficiency acquired in an atmosphere of excessive control from above, command dictatorship, and stifling of initiative are nothing but window dressing: pretty but deceptive, like a rosy wax apple on an attractive tray. Because their acquisition was not accompanied by thorough analysis and understanding of their activities on the part of the military aviators in question, or by an innovative approach to assigned tasks from the very outset. The existing system of combat training will simply not accept this, since it presupposes reducing personnel to a state of servitude by prohibiting initiative. The conservatism and dogmatic nature of this system kill any vibrant, nontrivial idea. But absurdity and organizational rigidity, unnecessary simplifications and restrictions are used as a weapon against that which is progressive, reasonable and sensible.

In addition, essentially this system does not provide for incentive for a pilot constantly to improve himself. I must state one reservation at this point, however. There are no particular problems with young pilots. Young pilots are infused with the desire to master their aircraft, to earn a higher proficiency rating, and to become a flight and squadron commander. But then you earn 1st class, and circumstances are such that you are not going to rise higher than squadron commander. What is there left? One is forced to accept the unenviable situation of eternally getting it from somebody else, of doing one and the same thing year after year. One has the prospect, as they say, of flailing the air until reaching retirement age. All incentives boil down to maintaining one's proficiency rating.

Pilots of course do not like this situation. They would like to undertake something new and interesting. I am convinced that such an opportunity would compensate to a considerable degree for the detriment to morale connected with getting stuck on the career ladder. But precisely at this point the loyal servants of the system, in the person of inspector pilots, as well as orders and directives, tell them: no... can't be done..... Impossible.... Stop rocking the boat.... Do your job. The system has a goodly number of demagogic devices at its disposal, which are virtually impossible to withstand. For example, our regimental commander tried for three years to obtain permission for a two-ship element to land on a runway 80 meters wide. He was unsuccessful.

I have long since arrived at the conclusion that in order to increase unit combat readiness by improving flying proficiency it is essential, first of all, to give the pilot (the experienced pilot) the opportunity to take personal responsibility for his level of skill and for the quality of preparation for a training sortie; secondly, he himself should determine the extent and form of preparation proper for flight operations. Third, the best pilots should be permitted to master an aircraft to the full extent permitted by regulations. Fourth, effective material incentives should be provided for improving combat flying and weapons delivery. Fifth, obtaining and maintaining a proficiency rating should involve the ability to perform one's designated missions. If I am wrong, then let the Air Force higher-ups refute my statements in a well-reasoned manner. In the final analysis we all need clarity.

* * *

From the Editors: In publishing this material we hope that the people in charge of combat training at the Air Force Main Staff will not ignore it, as they ignored the article by A. Korotchenko entitled "You Have Become a Pilot 1st Class. What Next?" (AVIATSIYA I KOSMONAVTIKA, No 12, 1989), which addresses the vital interests of flight personnel. The people in line air units would like to hear replies to these questions from Col Gen Avn A. Borsuk.

Changes in Aircraft Maintenance T/O Structure Urged

90R90004H Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 5, May 90 (signed to press 4 Apr 90) p 31

[Article, published under the heading "Aviation Engineering Service: Problems, Inquiry, Solutions," by Lt Col P. Karpenko, senior engineer, Military Transport Aviation Aviation Engineering Service: "Changes Are Required"]

[Text] **The CPSU Central Committee draft Platform submitted to the 28th CPSU Congress points to the need "to move toward military reform." What kind of a reform will it be? This question, judging by the editors' mail, is of concern to our readers. As we know, a great deal is already being done: Armed Forces manpower is being cut back, the structure of the Armed Forces is being improved, and new general military regulations and specific-area regulations are being drafted. At the same time, and this also is to the credit of perestroyka, today the direct originators of advanced know-how in the Air Force are taking increasingly more active part in discussing the problems of military organizational development and are stating and**

defending their point of view frankly and openly, in detail and in a well-reasoned manner. In particular, an article entitled "In Form and Content" [AVIATSIYA I KOSMONAVTIKA, No 9, 1989) has evoked considerable interest on the part of Military Transport Aviation specialist personnel. We offer our readers the following material on this topic.

In present-day conditions, when engineers and technicians are faced with the task of resolving many complex problems affecting the interests of various Air Force structures, the Aviation Engineering Service is performing a considerably larger number of tasks than is prescribed by its table of organization structure. This has been particularly vividly expressed in various approaches to solving the same problems and accomplishing the same tasks by the Armament Service, Logistics Service [Sluzhba tyla], and Aviation Engineering Service. For this reason the idea, presented in this article, to establish in the Air Force new organizational entities of an engineering and technical troops type, as we see it is fully in conformity with the spirit and content of the perestroyka which is being carried out in our country and in our Armed Forces. Establishment of a uniform structure of armament and aviation engineering service subunits will make it possible to consolidate matters pertaining to the state, condition, and operation of aircraft, support activities and maintaining aircraft in good serviceable condition, and will make it possible to resolve problems pertaining to operational readiness, effectiveness, and flight safety. Operational experience convinces us that these matters are directly related to the state and condition of aircraft, from the preparation of preliminary specifications for new aircraft, through testing, entry into operational service, operation and maintenance, right up to retirement from operational service.

We should note that recently specialist personnel from the Aviation Engineering Service and Air Force scientific research institutes have been enlisted to an increasing degree in assessing maintainability and formulating a servicing and maintenance system at the phases of design, building, and testing fixed-wing and rotary-wing aircraft. But this is clearly insufficient. It is necessary that matters pertaining to maintaining aircraft in proper working order and in a state of operational readiness, achieving a high degree of effectiveness of aircraft utilization in the process of operational training and during the conduct of combat operations be handled by the same Air Force subunits during the entire "life" of an aircraft, aircraft powerplants and armament. For this reason the establishment of new structural subdivisions in the Air Force is a demand of the times, a requirement of scientific and technological advance in military aviation.

Presently, however, Aviation Engineering Service personnel, when performing aircraft maintenance, must at the same time deal with matters applying to the Armament Service and Logistics Service. For example, requisitions for spare parts and expendable supplies and material submitted by the Aviation Engineering Service via the logistics service and armament service are not as a rule fully met. For this reason the time required to put maintenance-requiring aircraft back on the line depends to a considerable degree on the expediting abilities of the engineers and their ability to combine within themselves the functions of logistic support specialists and procurement agency. A particularly important role here is played by the unit deputy commander for aviation engineering service. Or take such a category as unit aircraft maintenance unit chief. In addition to organizing routine inspection, servicing and maintenance, including preventive maintenance, he must have a basic understanding of construction, procedures of operation and maintenance of boiler and other such facilities, and must even possess knowledge in the area of agriculture (some aircraft maintenance unit and division automotive maintenance shops run greenhouse farming operations).

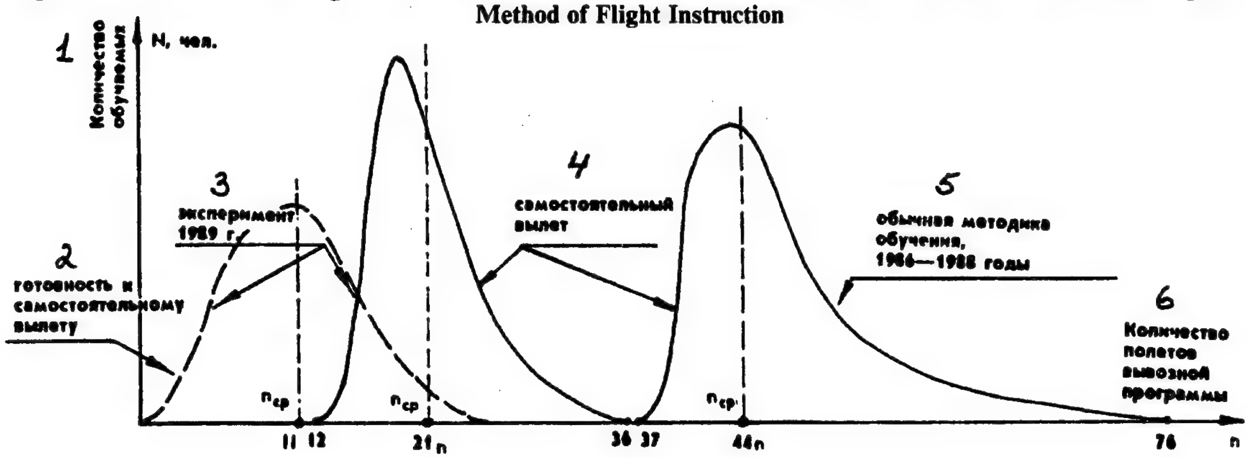
The inspection functions of aviation engineering service personnel have also recently become much more extensive. Their duties now include, for example, regular inspection of POL storage facilities, and ground servicing equipment and facilities (SNO), which, as we know, are entirely under the rear services subunits. And who is the one who most frequently takes SNO away from servicing aircraft? The duty engineer, of course. Things have reached the point where some unit commanders have begun holding the aviation engineering service people responsible for unsatisfactory condition on the part of SNO.

But how can we specifically embody the ideas contained in the article "In Form and Content"? It seems to me that no fundamental changes will be required in the air squadrons, regiments, and combined units [e.g. divisions]. The fact is that the aviation engineering service and rear services presently existing at this level handle virtually all matters pertaining to air unit armament. What is needed here is merely a certain redistribution or consolidation of a number of functions of the aviation engineering service and rear services.

Entry by third-generation and fourth-generation into operational service now compels us to alter the existing structure of the Aviation Engineering Service and to seek new ways to make its operations more effective. Presently underway in Military Transport Aviation subunits, for example, is an experiment on future aircraft maintenance in conformity with an altered table of organization structure. Conduct of this experiment also requires considerable restructuring of the operations of rear services subunits.

An important problem for Military Transport Aviation in the proposed structure of engineering and technical troops will be determination of the place within this system of senior flight engineers (senior flight technicians), as well as senior flight technicians in charge of aircraft and airdrop equipment, who are concurrently both aviation engineering service specialists and aircrew members.

Figure 7. Dual-Instruction Flights and Prediction of Student Pilot Readiness With the Usual Method and Proposed Method of Flight Instruction



Key:
1. Number of student pilots
2. Readiness to solo
3. 1989 experiment
4. Solo flight
5. Usual instruction method, 1986-1988
6. Number of dual-instruction flights

I also feel that the most difficult item will be the "breaking" of the existing structure of the administrative organization under the Commander in Chief of the Air Force. Of course what are needed here are specific studies with the active participation of scientific research institutes and Air Force higher educational institutions. I believe that reorganization of the Aviation Engineering Service will help substantially improve the quality and effectiveness of servicing and maintenance of aircraft, will make it possible to improve the level of Air Force operational readiness and flight safety, and will be in conformity with the spirit of the forthcoming military reform.

* * *

From the Editors: In view of the importance and urgency of the problem of changing the Air Force's table of organization structure as well as differences in the views and assessments contained in previously-published materials as well as in Lt Col P. Karpenko's article "Changes Are Required," we shall consider the matter still open for discussion. We would like to hear opinions on this matter by aviation engineering service personnel of other air components, of the Armament Service, and of all interested personnel.

New Student Pilot Training Method Proposed

90R900041 Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 5, May 90 (signed to press 4 Apr 90) pp 38-39

[Article, published under the heading "At Air Force Schools," by Military Instructor Pilot 1st Class Col N. Litvinchuk, candidate of technical sciences, docent: "Efficiency Reserve in Action"; concluding part of two-part article; part one appeared in the April 1990 issue of AVIATSIYA I KOSMONAVTIKA]

[Text] Of interest is the difference in training flights when assessing capability to solo and student pilots' actual first solo flight (see Figure 7), a difference which runs 10 training flights on the average. It can be considered as a safety factor or reserve of student moral-psychological training and preparation for solo flight. This is evidently close to the optimum. A smaller margin of safety would be dangerous. With a larger safety margin a pilot might lose confidence in his ability.

We should point out that in spite of the small number of instruction flights, the number of student pilots washing out of the dual-instruction program proved to be smaller than usual. Many students who had previously been considered weak performers became strong performers when given the opportunity to develop their abilities.

Figure 8. Variation of Forming Maneuver Sequences by Types of Flight Training.

Key:
1. Minimum number of performance-graded flights
2. Practice flights
3. Maximum number of performance-graded flights
4. Minimum number of practice flights
5. With the same number of flights (n) for all student pilots, the level of student pilot preparation is determined by:

Testing of student pilot readiness to fly as far as mastery of theory is concerned is done with a special list of questions, as well as according to a training and testing checklist. Items covered include knowledge of theory of flight, operation of systems and equipment, and knowledge of flying technique and maneuver execution procedures.

The lists of questions, scenario instructions and problems are prepared by flight instructor personnel and ground instructors. The purpose is to test a student's performance not by notebook entries but based on a student's actual knowledge.

Overall testing of student readiness is done in the ground-school classroom area, on the flight simulator, or in the aircraft cockpit, according to worked-out grading criteria.

The proposed method is designed to grade performance based on end result and presumes transition from quantitative to qualitative indices. It has a specific area of application, being effective only when the process of mastering something new is in progress and when the learning process must be intensified. In connection with this it is necessary to prepare special instruction programs, ensuring, with equal opportunities, intensive work both by the strong and the weak student. Figure 8 shows one possible variation. With the same number of dual-instruction flights, the sooner a student pilot masters flying technique, the more he will fly solo. Total number of hours of solo flight logged as well as the quality of solo flight can serve as the criteria of a student pilot's abilities and the level of his preparedness.

This approach also generated positive responses when training student pilots on the L-39 trainer. Work using this method must begin at first working with individual elements in the practice area, from the first year of flight training, shifting entirely to this approach by the end of flight school. Abandonment in turn of the practice of making training notebook entries "to cover legal bases" requires that the instructor pilot have legal protection and the elaboration of new job duties. Each individual, working toward the end result, should be responsible for his own work area.

A number of psychological barriers were discovered in the process of the experiments, such as skepticism on the part of some flight personnel, particularly supervisory personnel, about the capabilities of the student pilots, doubt on the part of some student pilots about their ability to work without demonstration, and the fear of making a departure from established instructional patterns.

We must also note that the student pilots who took part in the experiment, in spite of an increased work load, fully supported this approach in training. It enables them graphically to see the results of their work on the ground and in the air, provides stimulus, and develops confidence and ingenuity. There arises the desire to test one's abilities and to demonstrate them to others, a spirit of competition, and incentive to deepen one's knowledge of theory, since theory is called upon in the course of flight training. The present level of flight instructor proficiency makes it possible to transition immediately to this method of training. In addition to initial support of the experiment by the overwhelming majority of student pilots, however, as time passed they began to show a negative attitude toward it, developing into an attitude of hostility.

The reason for this was the fact that this work only partially affected the system of training. It gave free rein to the principal productive forces—the creative process of student training, but failed to affect production relations—organization and conduct of training within the framework of ROPLOK [expansion unknown]. These relations became cramped for this process and caused a conflict situation.

Productive relations in pilot training, as in other domains of production in this country, are defined by regulations and are grounded on an intensive-outlay mechanism, downward-leveling egalitarianism in wages, and lack of assessment of work performance according to the end result. In such a situation it becomes not only disadvantageous but dangerous as well to do excellent work and to work with initiative. For example, practically everybody who took part in the experiments or supported them, from school administration to the pilot cadets, were persecuted.

This tended to shape the public view: why should we do a better job? After all, we shall get nothing but grief, while the money saved will be given to those who do a poorer job.

What is the view of many high-ranking officers on this score? In addition to hushing up innovations which are disadvantageous to the existing system, they give the following justification: "We try to push down everything that is new and to which we are not accustomed. If it is viable, it will survive and thrive." And this mechanism of impeding things has been honed to perfection, ensuring that we are lagging behind even in matters of education and training.

The experiment also suggested several ways to correct the present situation. First of all it is a transition to teaching and instruction grounded on the laws of economics. It is high time to give serious thought to introducing elements of economic accountability at the regimental and squadron level, to changing the table of organization structure of training units and subunits, basing things on enhancing the role of the instructor pilot and ending his alienation from his job. He should value the profession of instructor, should have incentive to produce good results, and not endeavor to obtain a promotion as quickly as possible to a job which is not directly connected with instruction.

But do Air Force line units need a highly-trained Air Force flight school graduate? It is unquestionably easier for certain commanders to go on year after year merely noting the same deficiencies and shortcomings in their comments on young pilots than to change the structure of their subsequent training.

Does it make sense then to improve the work performance of the service schools? If it does not, then let us not deceive with our appeals Air Force personnel with initiative and creativity, subsequently subjecting them to persecution and disenchantment.

If the answer is yes, then we must reply to the following questions without delay: what is impeding us from achieving the world standard in training Air Force specialist personnel, and who is to blame for the foot-dragging?

Computer Program Selects Needed Map Sheets

90R90004J Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 5, May 90 (signed to press 4 Apr 90) pp 40-41

[Article, published under the heading "The Aviator and the Computer," by Military Pilot 2nd Class Capt V. Uzun: "In Place of Indexes to Adjacent Sheets"]

[Text] Selecting map sheets for gluing together a composite map covering a tactical area of operations, an area covered during a training flight, a target area or the area around a destination field takes up a great deal of time. The fact is that indexes to adjacent map sheets are on a very small scale and show only large terrain features and localities. Therefore when looking for a certain area or shifting from one scale to another, one must pore over and compare a large number of map sheets. Hence the idea of determining the identifying designation of map sheets using an Elektronika MK-85 microcomputer.

The task boils down to computing the identifying number of the sheet on which a point with specified coordinates is located, as well as the eight sheets positioned around it. The input data will be standard scales from 1:1,000,000 to 1:100,000 and the coordinates of the selected point (geodetic latitude and longitude). It takes less than one minute to obtain a solution. And this time is spent primarily on entering data and recording results.

A sheet at a scale of 1:1,000,000, with an alphanumeric designation, such as K-46, for example, is used as a basis for division of a map into numbered sheets and for a map letter and numbering designation system (see Figure 4). Map sheets of scales 1:500,000, 1:200,000, and 1:100,000 comprise 1/4th, 1/36th, and 1/144th of the map respectively. Therefore the third alphanumeric unit in the map sheet number is one of the first four letters of the Russian alphabet A, B, V, or G (K-46-B, see Figure 1), a Roman-numeral number from I to XXXVI (K-46-XVIII, see Figure 2), or an Arabic-numeral number from 1 to 144 (K-46-72, see Figure 3).

Figure 1. Map Sheet Lettering System for 1:500,000 Scale Sheets (K-46-B).

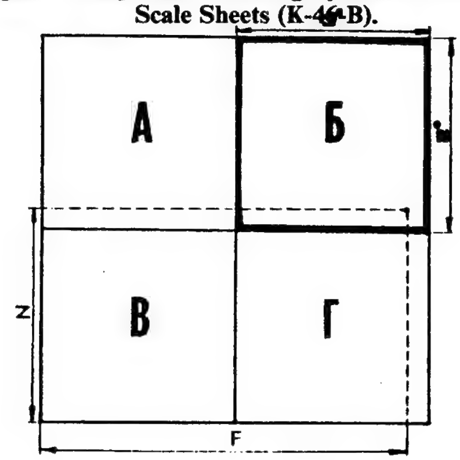


Figure 2. Map Sheet Designation System for 1:200,000 Scale Sheets (K-46-XVIII).

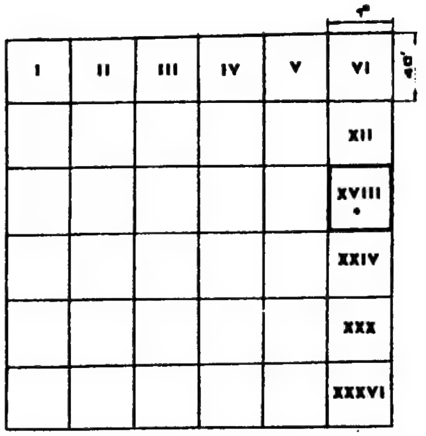


Figure 3. Map Sheet Designation System for 1:100,000 Scale Sheets (K-46-72).

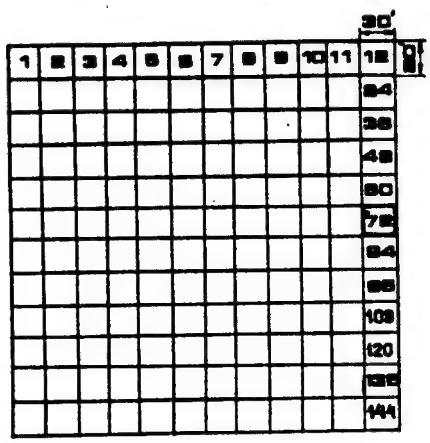
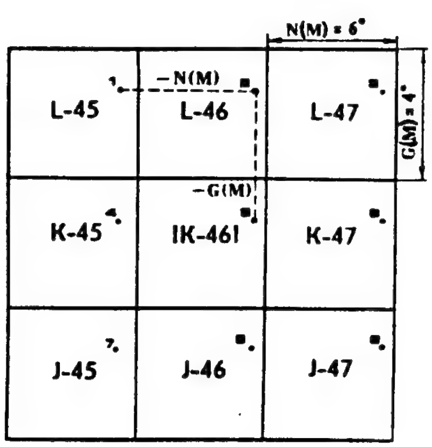


Figure 4. Procedure of Forming Map Sheet Designation for One Scale (1:1,000,000).



The first two alphanumeric units in a map sheet designation system are figured as follows. The zone in which the selected point is located is designated by a Latin letter. To find the point's serial number, one must divide the latitude of the point by the latitude of the zone in degrees, that is, by 4. A number signifies the column number. It is obtained by adding the quotient obtained by dividing the longitude of the point by the latitude of the column in degrees, that is, by 6, with 30 columns of the Western Hemisphere. The third alphanumeric unit of the sheet number is determined separately for each scale by sorting. The numbers of the sheets positioned around the sheet with the target point are determined by changing the coordinates by amounts equal to the length and width of a sheet of a specific scale (correction for latitude and longitude), in a specified sequence (see Figure 4).

Program

The program is written in Basic. Entry takes 20-25 minutes.

Program Instructions

The program can be placed in any of 10 existing files (0, 1,...., 9). Subsequently it can be called by pressing combined function key S and the corresponding file number key. The message "M km/cm?" on the display indicates that the microcomputer is ready to solve the problem.

After entering each of the input data items, press the EXE key:

"M km/cm?"—scale in kilometers per centimeter;

"B°?"—latitude of target point in degrees;

"B'?"—minutes of latitude;

"L°?"—longitude of point in degrees;

"L'?"—minutes of longitude.

When the designation number of the first map sheet appears on the screen, write it down and then press the EXE key again. After all nine map sheets are figured, "M km/cm?" will appear on the display, that is, indicating that the computer is ready for another cycle.

Remarks:

1. The sheet number of the sheet with the target point is indicated with two exclamation points (!K46!).

2. Enter west longitude with a minus sign ("-").

3. The third element of the sheet number for sheets of 1:200,000 scale is given in Arabic numerals instead of Roman numerals.

4. The program involves 480 steps.

Limitation:

This program can be used only in the Northern Hemisphere.

```
3 INPUT "Mкм/см",M,"B°",Z,"B'",W,"L° ",R,"L' ",T
6 Q=4:L=2:I=2/3:H=1/3:X=6:S=3:P=1:O=.5
9 FOR K=1 TO-1 STEP-1
12 FOR J=-1 TO 1
15 U=(Z+W/60+K*G(M))/4:C=(R+SGN R*T/60+J*N(M))/6
18 A$=CHR(65+INT U):D=31+INT C:IF R<0;D=D-1
21 IF M<5 THEN 30
24 IF K=0;IF J=0;PRINT"!";A$;D;"!":GOTO 66
27 PRINT A$;D:GOTO 66
30 N=FRAC U*4:F=FRAC C*6:IF R<0 ;F=6+F
33 IF M=2 THEN 54:IF M=1 THEN 63
36 IF N>2;IF F<3;B$="A"
39 IF N>2;IF F>3;B$="Б"
42 IF N<2;IF F<3;B$="B"
45 IF N<2;IF F>3; B$="Г"
48 IF K=0;IF J=0;PRINT"!";A$;D;B$;"!":GOTO 66
51 PRINT A$;D;B$:GOTO 66
54 V=31-INT(N/I)*6+INT F
57 IF K=0;IF J=0;PRINT"!";A$;D;V;"!":GOTO 66
60 PRINT A$;D;V:GOTO 66
63 V=133-INT(3*N)*12+INT(2*F):GOTO 57
66 NEXT J:NEXT K:GOTO 3
```

Example.

Input data: "M km/cm?"=10; "B°?"=42, "B'?"=0, "L°?"=93, "L'?"=0.

Results: L45 L46 L47 K45 !K46! K47 J45 J46 J47

Pion Satellites Described

90R90004K Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 5, May 90 (signed to press 4 Apr 90) pp 40-41

[Article, published under the heading "The Space Program Serving Science and the Economy," by V. Bass and Professor Yu. Tarasov, doctors of technical sciences: "Pions in Flight"]

[Text] In the comments accompanying the table entitled "Launches of Space Vehicles in the USSR in 1989" (AVIATSIYA I KOSMONAVTIKA, No 4, 1990), the readers probably noticed a satellite called Pion. Just what is this satellite and what is it designed to do?

Launches of Pion (passivnyy iskusstvennyy obyekt nablyudeniya [passive manmade observation target]) were performed by a single launch vehicle, together with the Resurs-F satellite; they were placed into circular orbits approximately 270 kilometers in altitude. They are intended to be used in studying density of the upper atmosphere. This project was authored by a student design office group at the Kuybyshev Aviation Institute imeni S. P. Korolev.

Development of the Pion is connected with the need for rapid determination of possible points of ground impact by unburned remnants of space vehicles upon uncontrolled entry into dense layers of the atmosphere. Examples of this are the emergency situations involving the U.S. Skylab Space Station and the Soviet Kosmos 954, Kosmos 1402, and Kosmos 1900 satellites, against which the developers of such complex hardware are at the present time unfortunately have no assurances. This situation also includes problems connected with littering space with various devices used in launching vehicles into orbit (fairings, tying materials, explosive bolts, springs, etc).

All Pions were built in the form of spheres 330 mm in diameter and weighing 50 kg each, and differed only in aerodynamic drag coefficient.

The standard coating used on one of the Pions was selected as a result of analysis of a series of experiments on models of these satellites in low-density aerodynamic vacuum conditions by the UkSSR Academy of Sciences Institute of Engineering Mechanics and the Central Institute of Aerodynamics and Hydrodynamics imeni Professor N. Ye. Zhukovskiy.

Involving students in the development of space hardware makes it possible to train engineers capable of thinking in an innovative and creative manner and capable of solving complex technical problems, and also makes it possible to develop in students the skills and habits of independent scientific effort. More than 10 satellite designs were analyzed at the student design office in the process of designing the Pion system: ranging from a glass sphere with an internal corner reflector to a complex metal-composite structure. The students examined not only design problems but also the technology of manufacture in conditions of existing experimental production.

Meeting all requirements, as well as consideration of the dimensions of "free space" offered by the Resurs-F for piggyback launch into orbit determined the appearance of the Pion satellite and the configuration of its systems. Development and implementation of the satellite project were handled by the Nauka Scientific and Technical Center. Students took active part in building the satellite and in design and development testing, acquiring skills and learning from the experts in the process.

It is planned to continue these experiments in the future with the aid of rigid thin-walled and inflatable probes launched from the Mir space station. Using lightweight (weighing from several grams to about 10 kilograms) inflatable probes made of thin, metallized polyethylene terephthalate film makes it possible at moderate cost substantially to broaden the possibilities of full-scale experiments in the area of geometry of the target objects. It is planned to launch spherical probes ranging from several centimeters to about 10 meters in diameter, as well as conical and cylindrical probes, plus targets of other shapes as well. The probes will be packed into a special container, which will be taken out through an air lock on the space station and opened at the designated time, releasing the enclosed gasbag. The bag fills out from the residual air remaining in it during packing.

From the standpoint of aerodynamics, using in a full-scale experiment lightweight balloon satellites of various size and shapes, which remain in orbit for one or two revolutions, makes it possible to examine the most critical initial segment of entry into dense layers of atmosphere in conditions of balloon shaping and motion during an initial period of time, observable from the space station.

Just as in the case of the Pions, observation of the parameters of motion of the satellite probes will take place against the background of standard spheres launched sequentially from the other satellites. Observation of orbital components will be done both by passive methods and using special radio beacons.

This experiment will also make it possible to test the possibility of utilizing the "falling" bodies method to investigate the upper boundary layers of the atmosphere.

It is planned to commence the experiment at the end of 1990. This coincides in time with the 11-year solar activity maximum, when deceleration of objects traveling within the atmosphere takes place most intensively.

Regular launching of short- and long-lived standard passive satellites and prompt processing of data on change in their orbits opens up the possibility of establishing a service providing current evaluation of the state of the upper atmosphere. It is precisely the existence of an uncertainty factor which has compelled the developers of space hardware to design conservatively, introducing 30-50 percent "safety margins" against the calculated ballistic existence figures for space vehicles plus reserve supply of attitude control system motor propulsion medium. A frequent result of this would be that in order to maintain a continuously functioning system of satellites, for example, it would be necessary to launch the next Kosmos before the previous one had reached the end of its useful life.

Research conducted using the Pions will promote further study of physics of the upper atmosphere and the effect of forces of nongravitational nature on change in the paths of manmade objects traveling through the upper atmosphere, that is, matters pertaining to theory and practice of gaining knowledge of near-earth space.

Satellite VLF Experiment Described

90R90004L Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 5, May 90 (signed to press 4 Apr 90) p 42

[Article, published under the heading "International Cooperation," by I. Kuleshov: "'Active' Experiment"]

[Text] The Interkosmos 24 space vehicle, launched in October 1989, comprises a plasma-physics laboratory for investigating the processes of propagation of VLF electromagnetic waves in the earth's magnetosphere and their interaction with energetically-charged particles in the radiation belts. Development of the scientific program for this international experiment, christened with the name "Aktivnyy" [Active], and the building of some of the onboard and ground instruments were conducted by scientists at the USSR Academy of Sciences Institute for Space Research and the USSR Academy of Sciences Institute of Terrestrial Magnetism, the Ionosphere and Propagation of Radio Waves, jointly with specialists from Bulgaria, Hungary, the GDR, Poland, Romania, Cuba, and Czechoslovakia.

Following launch of Interkosmos 24, scientists and specialists from Brazil, New Zealand, Canada, Norway, the United States, Finland, and Japan joined the others in the "Active" experiment. These scientists, using their ground facilities, are receiving and processing information.

So-called whistlers—an aggregate of complex natural phenomena, in particular lightning-produced phenomena, in the very low frequency (VLF) band, have become an object of scientific investigation within the framework of the "Active" Program. Upon reaching the ionosphere, as a consequence of interaction with ionospheric electrons, they travel along the force lines of the geomagnetic field. Traveling vast distances of several earth's radii and reflecting at a magnetic conjugate point, whistlers provide a great deal of interesting information on the parameters of the ionospheric and magnetospheric plasma along their path.

In the past these phenomena were studied with the aid of manmade whistlers generated by powerful ground-based VLF transmitters. Their effectiveness is very poor, however, due to the poor electromagnetic linkage between

the lower atmosphere, the ionosphere and magnetosphere. A totally different situation occurs when a powerful VLF transmitter is placed in the upper ionosphere.

The Aktivnyy experiment, which involves the participation of two space vehicles put into orbit by a single launch vehicle, is the first satellite experiment of its kind. A powerful pulsed VLF transmitter (10 kHz band) with a 20 meter diameter antenna is carried on the first of these space vehicles, while the second vehicle—the Czechoslovak Magion 2 satellite—carries diagnostic instrumentation. Following launch into orbit, the latter separated from the main vehicle, forming a unique probe. In the future the distance between them will increase to as much as 100 kilometers, using the Magion 2's vernier rocket motor. This is the first space experiment in which a controllable subsatellite is used to investigate the spatial structure of the physical phenomena accompanying injection of powerful VLF radiation into the ionosphere. Not only the zone close to the emitter but also phenomena in the intermediate and far zones are investigated using the subsatellite.

We should note, however, that the satellite's service life is limited both in terms of number of discharge-charge cycles (several hundred) as well as operating mode (providing power to equipment with a total output rating of five kilowatts during transmitter operation). For this reason the equipment carried by the main vehicle and the subsatellite will be used in parallel with active modes, and entirely in the future, to continue the investigation of the natural processes taking place in near-earth space.

In coming years another active experiment will be conducted in circumterrestrial space, designated APEX (active plasma experiment). The scientific research institutes' plans include further investigation of the plasma layer. They naturally will be changed and adjusted, depending on the results of current research. An important role in this work is played by the Interkosmos program, which makes it possible to accomplish multilateral cooperation by countries interested in space research.

Problems Facing Soviet Space Program

90R90004M Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 5, May 90 (signed to press 4 Apr 90) pp 43-45

[Article, published under the heading "Contemporary Issues," by G. Glabay, science editor, space exploration department of the magazine AVIATSIYA I KOSMONAVTIKA: "Terrestrial Orbits of the Space Program"]

[Text] **The Pavilion Is Also Without a Master....**

On 6 April 1989 the newspaper PRAVDA published the terms of a competition to select journalist candidates for training for a space mission. And soon, as the competition initiators note, our colleague will be able to "take a fresh, unbiased look" from orbit at all that which our cosmonauts have been unable to see over a period of 30 years. For the time being, however, just the medical examination of candidates will cost at least several tens of thousands of rubles. Incidentally, nobody is giving any thought to this, including the journalists themselves.

It would seem that there is a fundamental difference in the very essence of future flights and reports from space by the Soviet and by the Japanese journalists. Even if their accounts begin with telling "how the sun rose," as, incidentally, the accounts of past cosmonauts have, the end result of their activities will differ substantially.

Japan, which in 1970 launched a satellite into orbit with a Japanese-built launch vehicle, does not yet have a Japanese astronaut. In addition, Japan has completed drawing up a large-scale program for practical exploitation of the lunar surface by the year 2005, and this flight will be a prelude to implementation of that plan. For this reason it would surely be of interest to Japanese specialists to know the scientific methodological and testing foundation of the Soviet Union and to assess the dynamic functioning of the entire present structure of the Mir orbital space station system. Nor should one forget about the fact that in these matters we have our own engineering and design solutions, about which many of us unfortunately know little. But let us return to the terrestrial problems of the space program.

It so happens that since the terms and conditions of the competition were made public I have twice happened to visit the Space pavilion at the Exhibition of Achievements of the USSR Economy. The situation at the pavilion got me to thinking.

Apparently contact with the heroes of space and their exploits as well as the professional desire of some journalists to be at the center of historic events, and awareness of their own significance, enable them to write about the space program today with amazing ease, and to write tomorrow about psychotherapist A. Kashpirovskiy, for example, relegating the "terrestrial" problems of the Soviet space program to a secondary level. But there are many of these problems, and they have long been waiting for concerned intervention by the mass media.

Take the Space pavilion. It is supposed to acquaint visitors with the achievements of the Soviet space program. Do you think that one can see at the pavilion, for example, the Buran space shuttle or the Energiya launch vehicle? One cannot. It turns out that in order to become acquainted with the latest achievements in Soviet space hardware, one must travel abroad. Exhibiting of Soviet space hardware in foreign countries is organized by the Academy of Sciences and USSR Glavkosmos.

Such models as, for example, the Lunokhod, the Foton satellite, the Mir space station, the Kvant module, and the Progress space freighter are simply nowhere to be seen at the exhibit pavilion. Nor are there any launch vehicles on exhibit here. And this in a country which

possesses such a broad variety of launch vehicles capable of boosting the most diverse payloads into orbit. And yet the United States has built and beautifully equipped a space museum.

Apparently the only explanation for this is a lack of interministerial coordination, and particularly an absence of unified, committed leadership. This is why during the last several years the exhibit at the Space pavilion fails to reflect the current state of the Soviet space program. And the exhibit which recently opened there, which lacks a single new exhibit item, offers vivid confirmation of this.

The building in which the exhibit is housed was built in 1939. It is presently badly in need of repair. The so-called repair and refurbishing of exhibition halls, conducted in 1982-1983, failed to alter the situation. Just as before, in summer the exhibits are lashed by rain, and in winter they are covered by snow. Publicity of genuine achievements, technical equipment. and means of display are far below the required level of exhibiting activity. This very large exhibition building is not heated in winter. And yet each year this pavilion is visited by approximately 10 million Soviet citizens and foreigners, in hopes of learning something new.

In March 1987 construction of a new Space pavilion on the grounds of the Economic Exhibition, with an exhibit space of 10,000 square meters, was formally articulated in an order issued by the USSR Council of Ministers. But it was not until 1988 that the ministries finally divided up functions among one another, signing a protocol according to which the Economic Exhibition was designated as client and general contractor, while the USSR Academy of Sciences, Minobshchemash, and Minmontazhspetsstroy were assigned the functions of construction subcontractor organizations. We should note that the client is just now conducting a design competition for the facility. A rather inauspicious beginning....

And yet 1992 was declared to be International Space Year by a resolution passed by the UN General Assembly. Which of our ministries is going to take it upon itself to defend the prestige of the Soviet space program?

Should It Be Trimmed?

In 1989 expenditures on economic and scientific space programs totaled 1.7 billion rubles; military space program expenditures totaled 3.9 billion; expenditures on the Buran space shuttle system totaled 1.3 billion; total expenditures were 6.9 billion rubles. This year financing is to be reduced by 10 percent. At the same time some members of the USSR Supreme Soviet demand that the "space" budget be trimmed even more. Let us consider whether this is a lot or a little. We shall proceed not from emotions but from realistic calculations.

Here is a very simple example. According to elementary calculations, each year it costs each and every one of us 36 rubles to maintain the personal cars of the administrative-command system, while we pay only six rubles for the conduct of economic and scientific space research, which effectively influences scientific and technological advance.

If we slow the pace of the space program, we shall fall even further behind in other branches, and that means that we shall fall behind in the economy as a whole. This, however, is apparently of little interest to Academician G. Ginzburg (IZVESTIYA, 2 January 1990). He is apparently more concerned with economizing in time and manpower as regards administrative and management personnel, and he is more interested in the effect of the lack of a vehicle on the quality of their labor. Transforming personal cars into official cars by means of verbal manipulation, he warns us against ill-conceived decisions. We must understand that one should not cut 10 billion rubles from expenses on operating and maintaining cars.

But there exist, in addition to personal cars, a great many other "privileges" as well, which involve substantial financial outlays. Nor can we, we are told for the umpteenth time, reduce annual expenditures of about 40 billion rubles on the cost of administrative and management staff. And it is hard to believe that we have become so hopelessly impoverished in soul if we do not want to give up even a tiny bit of personal privileges for the benefit of the homeland.

Turning to economic activities, here too we shall see possibilities not only for increasing the prosperity of the Soviet people but also for increasing appropriations for the space program, for our agricultural production losses alone in 1988, according to various estimates, ran from 47 to 95 billion rubles, and in numerical terms this exceeds the U.S. space budget for last year by a factor of 1.6-3.2.

And what about continuing construction on the "construction projects of the century"? Without going into environmental problems, we shall note that the construction of oil and gas chemical industry complexes in Tyumen Oblast will cost a total of 90-100 billion rubles in order to complete all necessary work. And delay in bringing even one complex on-stream, such as the Tobolsk, will make it necessary for our country to pay back 287 million dollars in Western loans. And this with our budget deficits! Our country is really something.

It seems that only we must prove that the space program is necessary and that expenditures on it are warranted. Such a question does not come up anywhere else in the world, even in the developing countries. As for the developed countries, the U.S. space program budget for 1989 totaled 29.6 billion dollars, the French space program budget totaled 7.7 billion francs, the West German program budget totaled 35 million West German marks, and the Italian space program budget totaled 800 billion lire. British space program appropriations totaled 120.9

million pounds sterling for the years 1987 and 1988 combined. Sweden, Austria, Finland, and Israel also have space programs....

Free Rein to Commerce!

Unquestionably, with the present state of our economy, reasonable and intelligent elements are needed everywhere. Nor is there any question about the necessity of increasing return on funds invested in the space program.

Take our launch vehicles, for example. According to statistics, they are the world's most reliable. They have not been widely used, however, to launch foreign satellites. The problem here is not inadequate ability to compete but rather the artificial restrictions laid down by the policies of the Western countries. And yet the launching of just one communications satellite into geostationary orbit would put 80 million dollars into our treasury, and there are about 150 such satellites on the world market. All that needs to be done is for us to be able to reach a contractual agreement. In addition, due to our "secrecy," commercial Soviet space program activities did not commence until March 1988, and then only timidly, with the launch of an Indian IRS-1A satellite. The USSR received 7.5 million dollars for this launch. International cooperation in this area is increasing today, although slowly. A contract with the U.S. company Energetic Satellite Corporation, for example, holds promise of 54 million dollars for us.

We are also beginning to count money in such an area as training foreign nationals to fly manned missions aboard Soviet spacecraft. And although 13 foreign nationals have flown to date, nevertheless serious commercial business is just getting started. Austria, Japan, and Great Britain have recently expressed the desire to take part in joint missions. Representatives of other countries could be added to this list in conformity with plans for international cooperation.

Alongside one-shot programs, long-range programs for cooperation in the area of manned missions are also becoming a realistic possibility. An example of this is the signing last December in Moscow of a 10-year agreement with France, according to which five joint manned missions are to be flown. The first is scheduled for 1992. It will contribute 12 million dollars to our economy.

After stating the above, one is impelled to ask the impetuous budget slashers: "And what should be the first thing to cut? These ties, toward which our space program has been proceeding over the course of many years, or should we cut back our own scientific programs and projects?" I am not talking about design and engineering projects, which must commence right now, of course, if we want to send the first unmanned vehicle to the Martian surface in 1994. But we do not have a cent for these projects.

Now a few words about scientific and technological advance and "space" projects. Today one can fairly frequently hear it said that the space program is giving nothing to the economy. As a rule such statements are dictated by the fine desire to improve our people's living standards. Even the finest thoughts and statements, however, are dangerous if they are not backed up by thorough knowledge of the substance of the matter, because, promoting the forming of a negative attitude toward space research on the part of the public, they unwittingly lead to the deliberate—although a point that the majority do not realize—collapse of a powerful stimulator of scientific and technological advance. A halt or delay in the advance of the space program at this moment in history will not only strip our country of preeminence in this field but will also constitute loss of its current position of strength.

And now, what about the space program's contribution to the economy? Why do we refer only to the most recent projects, connected with the Energiya-Buran system, with which all of us are better acquainted than with the classified space program subject matter of past years? Just what does this system offer to representatives of other branches of industry? 581 suggestions and proposals on adoption of the newest technologies, materials, designs and structures. We shall name just a few.

For example, a technique of predicting a critical state of a part or component could find extensive application in electrical engineering, the automotive industry, and in shipbuilding.... In short, wherever it is necessary to ensure satisfactory condition and status and long service life of instruments and machinery. And means of measuring fuel level in tanks with an accuracy of 2 mm could be utilized in the chemical, gas and oil refining industry. Sensor-transducers provide capability to measure with an accuracy of within 2 percent the continuity of flow of water, gasoline, oil, milk, or any other liquid in pipes up to 150 mm in diameter. Tightly-sealed guaranteed explosionproof connections can be used in mines and in the chemical industry, while high-temperature polymer composites, adhesives, and synthetic felts can find applications in the automotive industry, in the machine tool industry, in medicine, agriculture, and radio electronics. Tile material could be used for highly-efficient heat insulation for high-temperature furnaces. Its utilization would make it possible to reduce electric power consumption by up to 30-50 percent. Carbon-based composites are well suited for long-lived electric furnace heaters, crucibles, aircraft brakes, etc.

As you can well understand, these few examples cannot fully describe the entire acquired potential of the system developers; after all, 48 new materials were developed just for the Buran orbital vehicle, with many of these new materials superior in some parameters not only to counterpart Soviet materials but on a worldwide basis as well.

But where can all this be seen, appraised, learned, and subsequently utilized in the economy? Nowhere! Of course if we do not consider the branch exhibit of the Kompozit Scientific-Production Association, to which

not everybody has access, plus isolated articles in newspapers and journals. Although even this pittance has evoked interest in obtaining equipment and documentation on the part of the people at the Novolipetskiy Metallurgical Combine, the heavy machine building plant in the city of Omsk, and oil refining industry people in Kuybyshev Oblast and at a number of other enterprises. A middleman is needed for extensive adoption of space program developments into the economy. It seems to me that the Space pavilion or some other organization under the aegis of USSR Glavkosmos could take on the role of such a center.

After all this, how can one seriously address the questions of return on investment regarding money spent on the space program?

That Wonder-Working Word "Conversion"

Another foreign word—"konversiya" [conversion]—has recently entered the Russian language, a word which means transformation, restructuring, and which today is frequently used in combination with the words, "oboronnaya promyshlennost" [defense industry]. And now for the umpteenth time we, waiting with hope and tender emotion, are once again expecting a socioeconomic miracle, forgetting the fact that we already have dozens of ministries of "all kinds of" engineering and instruments pertaining to the manufacture of civilian goods.

Let us consider the thought that by 1995 more than 60 percent of the output of the defense complex will be civilian goods, with the aid of accelerated conversion. Once again accelerated development! Over the course of 70 years we have already messed up on an accelerated basis everything that could be messed up. But what about now? We are not campaigning against alcoholism here, but are turning a heavyweight economy, which has attained enormous size, onto a peacetime footing. And for that reason we must not only define the means of conversion in an extremely precise manner but must also have the ability to utilize these means in a skillful manner, for converting over established workforces to the development and manufacture of new goods will involuntarily lead to a decline in production volume, labor productivity, and cutback in payroll and economic incentive fund.

At the present time, however, in most cases everything is being done in an unsystematic manner, in haste and without thinking things through. Who, for example, can say how much of what we should be producing today, and particularly "tomorrow"? How many refrigerators, radios, washing machines, or other items must be produced to saturate at least the domestic market? To what goods should priority be given? Where is there a unified, balanced, comprehensive conversion program? So we have each enterprise deciding these questions according to its own specialization. Who is creating and establishing combined commerce? Who is assuming the task of developing large, costly, cumbersome systems, which even right now will evidently not be in great demand, and who, without giving much thought to the matter, has simply converted to the manufacture of framing units for garden plot huts, barrels, and shovels?

At one time, more than 50 years ago, world-famous aircraft designer A. Yakovlev began building his airplanes in a bedframe manufacturing shop, while today, as we see on television, the assembly and testing building for the Energiya-Buran system at Baykonur is being used to manufacture bedsteads. So we have come full circle? And what about the elite segment of our intellectual potential?

Of course one can compel the Ministry of General Machine Building to build automatic lines for processing agricultural products. But who can assure us that a process of degradation and "brain drain" will not take place here as well? And when after some time we once again proceed with space projects, we shall suddenly see that the many-years cooperative effort between scientific and production workforces has fallen apart, while the Soviet space program has lost its leading position, and we shall be criticized not for changing the course of rivers but for the fact that we did these stupid things.

Obviously we should be addressing the matter not of converting enterprises but rather converting the results of space research and rocket and space hardware technologies for economic benefit.

What Has Happened to the Word "First"?

The interministerial approach and the classified nature of space program projects also apparently engender a situation whereby every supervisor is his own boss. Is this not why our Glavkosmos is today far from being a NASA? Nor is it apparent how space program development strategy and coordination of space program activities are determined, and by whom. As a result of all this we are seeing a decline in the preeminence of the Soviet space program, pride in the accomplishments of the pioneers in space, and interest in space research.

Some publishing houses, reacting like a barometer to the atmosphere within society, are ceasing to accept manuscripts and are postponing the dates for publishing books on space topics. We are seeing on the Central Television All-Union Program the special almanac "Man, Earth, and the Universe" increasingly less frequently and at a time which is inconvenient for many people. And this is perhaps the only program devoted to space.

And no less disappointing is the fact that this country, which ushered in the space age for mankind, which has been credited with many historic firsts, over the period of 32 years has not established a magazine or journal specifically specializing in the space program and space exploration. Do the veterans who were there at the beginning not have an obligation today, in an era of glasnost, to tell us, and to tell young people particularly, about the history of development of the space program? In what publications could the developers of space hardware present a series of articles dealing with the

development of our space hardware? Or are we going to write this history when their great accomplishments have been relegated to oblivion and when it becomes possible, as has occurred repeatedly in the past, to write the "necessary" names into this history. And how many pages are devoted today, and in what publication, to space topics for children and young people? And not only for them?

To our shame, countries which possess scientific and technological potential far below the level needed for space flight have such a magazine or journal. In the United States NASA alone publishes four special magazines and journals dealing with the space program.

We should note that throughout the world young people are being actively enlisted to the task of carrying out the scientific and practical tasks of space exploration and research. The Association of Young Astronauts, which has a membership of more than 300,000 students, has been in existence since 1984 in the United States. The situation is similar in Canada and Japan. These countries see their intellectual reserves in such associations.

Recently the Soyuz All-Union Youth Aerospace Society was established in this country. Its founders include the All-Union Komsomol Central Committee, the USSR Academy of Sciences, USSR Glavkosmos, the DOSAAF Central Committee, the USSR Federation of Astronautics, and the USSR State Committees on Public Education, Science and Technology....

Quite frankly, there is little hope that our Soyuz will become a vigorous, active organization of young enthusiasts which would provide a reliable reserve for the Soviet space program. It is experiencing too many problems in order to accomplish the task of spreading its wings, and its membership is only about 36,000.

* * *

This article does not claim that the views and opinions expressed herein are not subject to debate. It is merely an attempt to draw the attention of specialists and the energy of journalists toward the terrestrial problems of our country's space program.

Articles Not Translated

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